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New York Subway Matters. A SHORT time ago we ventured to point out on this page that Mayor Grant, in his praiseworthy zeal for putting wires underground, was a little hasty, and was losing sight of a great many difficulties that would impede the work. Since that time the explosions in the subway uptown have occurred, calling attention to one of the difficulties, and now the Western Union Company has invoked the strong arm of the United States Courts to check the pole-cutting of the Board, giving a prompt illustration of some other troubles that have to be encountered. The belief is that in this matter the Western Union Company is in earnest, and that it will be a long time before the Board succeeds in bringing the company to terms, and then probably those terms will be the company's own.

The Coxe Decision. THE great interest taken by the electrical public in the Coxe decision in the storage battery suit has been remarkably shown by the great demand for our issue of last week, in which the decision appeared exclusively. The rush for the issue confirms our judgment, as to the importance of the matter, leading us to devote so much space to it as to give the decision in full, in spite of its extreme length. This week the fight is, as will be seen, maintained gallantly in our reading and advertising pages.

Oil Fuel in Central Stations. ONE of the leading topics of discussion at the recent meeting of the National Electric Light Association was the use of oil as a fuel in electric light stations. In the papers and debates a number of points as to safety and economy were touched upon, and it was made clear that the subject was regarded by nearly all the speakers as being in a hopeful phase. In view of the great interest taken in the matter, and of its obvious importance, we are glad to be able to lay before our readers this week an illustrated description of apparatus specially devised for the consumption of oil as fuel. It will be noted by those who have followed the subject that the plan detailed gets rid of many of the objections raised; and, while we have not had opportunities to watch it in practical operation, we think that it presents a neat solution of the problems involved.

Telephone Figures. WE publish on another page the annual report of the American Bell Telephone Company, showing the affairs of that corporation to be in a prosperous and flourishing condition. The company earned $24.45 per share on its stock, as against $20.80 in 1887, and paid dividends during the year of $18 per share, as against $16 per share in 1887. The figures of work done indicate a steady growth in the number of subscribers, exchanges, miles of wire, etc., and the statement that altogether $2,200,000 have been spent on the long distance service is a proof that the company is far sighted as to the lines along which the telephone business of the future will largely develop. The whole report is an interesting commentary upon the great benefits of a patent system which thus secures so handsome a reward to the investors in and inventors of the telephone, and so much convenience to the public.

Circuit Construction. A GLANCE at our columns this week will show that in the first place improvements in circuit construction are constantly going on, and also next that others are still required. We think that all interested in good construction work will be glad to learn of the introduction of an insulating staple for securing wires in position, for it is evident that even with the best materials a careless workman, by the use of metal staples, may vitiate all the benefits to be obtained from them. We need not here enlarge on all the good results to be derived from insulating staples, but their recommendation by the Board of Fire Underwriters is in itself sufficient to show the appreciation accorded to a timely improvement. In the matter of arc circuits, a contributor draws attention to a weakness which often results in damage to arc lamps, due to the manner in which circuit wires are attached to the lamps, and he suggests a good plan of overcoming the difficulty. As regards the improvements still to be made, Lieut. Hutchins, who has had considerable experience with the apparatus of various manufacturers, points out that in the matter of lamp sockets and switches there is still room for betterment, and he argues that this class of apparatus should be so constructed as not to require the attention that some of the pieces now do in order to keep them in operative condition. We hope the time will come when more attention will be devoted to these details, for upon them, after all, depends much of the convenience which electric distribution claims and affords.

Telephone Improvement. THE report of the American Bell Telephone Company alludes briefly to the fact that experiments are constantly being carried on for the improvement of apparatus and service, but it may appear strange to many that so few improvements see the light of day in the public service. We find, in fact, complaint that telephony has, from a scientific standpoint, made little improvement here since its introduction. It is probable, however, that all the improvements which have been made in the laboratory would not be considered an unalloyed benefit, if placed upon the telephone circuits as they exist to-day, and that indeed most improvements in details of apparatus can only be successfully introduced when single circuits are discarded and replaced by the complete metallic. Such a change would at once permit of the employment of a more powerful transmitter than the Blake, but with a single circuit any increase in the transmitting currents would entail an annoying increase in induction, which evidently could only be obviated by metallic circuits. As also pointed out in the report, the introduction of metallic circuits on city lines would greatly increase the scope and value of the long-distance lines now being run through so many States, and which are for the greater part entirely unavailable for general use for the reason already given. We hope, therefore, that the time is not far distant when metallic circuits will be the rule for all telephonic service, and that their introduction will be the starting point for the practical operation of the improved devices which exist to-day in available shape.

Hemp-Covered Cables. THE protests which have been made by Mr. Justice Weatherbe, of Halifax, against the further laying of iron armored cables has called forth the comments of our keenly critical contemporary, the London *Electrical Review*, and to these Mr. Justice Weatherbe replies in a summary of the case, which appears on another page. Probably the most interesting of his arguments against the use of iron brought forward is that in which he points out that long before the armor itself is reduced in section by corrosion another action comes into play, namely, the twisting or writhing of the armor wires, which force or latent tendency is so great as to rupture the weakened armor and sever the core. Justice Weatherbe fortifies his argument by an interesting experiment which can be easily tried; and this twisting action may probably be blamable for many of the cable ruptures of the past. A critical examination of the cables ruptured in service ought to show whether this action is a prevalent one, and those in charge of cable ships might, it seems, throw considerable light on this part of the subject.

The Future of Street Railways. WE believe that the public have little idea as to the unrest that pervades street railway circles in regard to motive power, and the desire there is among street railway men for something better than animal locomotion. It may be well, therefore, to call attention to the facts recently developed by inquiries instituted by the *Street Railway Journal*. On the basis of several hundred replies, that enterprising paper reports that 18 per cent. do not contemplate any change from horses; 15½ per cent. did not answer, and hence may be placed in the same category of conservatives; 16 per cent. are "on the fence" awaiting developments and preferring some kind of mechanical traction, 16½ per cent. favor mechanical methods other than electricity; 34 per cent. are using or will adopt the electric motor. In this last class, one-third prefer the overhead system, and one-ninth like the storage battery. Thus it will be seen that practically 66½ per cent. of the roads of the country are already saying good bye to horses; and that of these more than one-half are supporters of electricity. We think that electrical engineers have no reason to complain of this showing made by an impartial authority. To us it is a justification of our steadfast advocacy of the electric motor during the last five years for street railways. We are perfectly satisfied with the figures, but we are of opinion that a canvas of the new roads, as distinguished from those now in operation, would bring out an overwhelming preponderance of sentiment in favor of electricity. Probably far more than half the new roads have satisfied themselves that electricity is what they want.

A New Marine Dynamo. WE have more than once called attention to the fact that American dynamo builders have not deemed it worth their while to design special machines for marine work similar to those which have come into vogue abroad. The reason for this may probably be looked for mainly in the fact that there was but little work of this character to be carried out, and that it did not "pay" to devote special attention to this class of work. With the increase of our navy, however, the time has come when a special type of machine is more than ever desirable, and we are glad to note that a good start has been made in dynamos specially adapted to ship lighting. Our description of the new Edison machine designed for this purpose is worthy of close attention, as we find embodied therein a departure from previous practice in more than one sense. It was evident that in order to obtain the required output of the machine at the low speed of 400 revolutions per minute, a multipolar arrangement had to be adopted and the novel manner in which this has been carried out will claim the attention of all interested in dynamo construction. It will be seen from the description that while the machine is of the Gramme type, with internal pole pieces, the latter are not employed in the same manner as such pole pieces have been in former machines of the same type. In those, the internal pole pieces merely acted as reinforcements of the external pole pieces, being in most cases directly connected with them. In this case, however, the internal pole pieces are independent of the external, and present an opposite polarity to the revolving armature. Thus, we have an 8-pole machine in which the economy of wire and space has been well looked after, and which is mainly obtained by the ingenious use of but a single magnetizing coil. With the slow speed required, a direct connection of the engine to the machine is possible, and this part of the work has also been very well carried out in the double Armington-Sims engine, which drives the dynamo. It will be noticed also that the output per pound of material, now exceedingly high, will, it is said, be increased in a yet newer machine in course of construction. We are glad to see this new departure, and must congratulate the company on its enterprise and ability in dealing with the problems of the case.

NEW BOOKS.

THE THEORY AND PRACTICE OF ABSOLUTE MEASUREMENTS IN ELECTRICITY AND MAGNETISM. By ANDREW GRAY, M. A., F. R. S. E. In two volumes. Vol. I.: New York, Macmillan & Company, 1888. 5 × 7½. Price, $3.25.

To those who are familiar with the small book published by the author in 1884, under the same title, the present work will appear as a most timely expansion. The author has filled up his outline and followed out each idea in a remarkably complete and logical manner. The present volume treats of electricity alone, and the opening chapter is devoted specially to the electrostatic theory. Here we find an elaborate discussion on electrostatic attraction and repulsion, and potential, and the general propositions regarding the potential energy of an electric system. Section 3 of this chapter is allotted to electrostatic capacity, and embraces a discussion of the capacity of conductors of various forms, such as the spherical, the ellipsoidal, etc., the Maclaurin theorem of attraction of ellipsoids; and here also is discussed the parallel plate condenser, and the theory of the symmetrical electrometer. Green's theorem on electric images and problems of inversion constitute Section 4 of this chapter, which is ended by a discussion of the analogy between the theory of heat conduction and that of electrostatics. The question of specific inductive capacity is naturally treated here with considerable fullness, and the capacities of various forms and substances are fully discussed; while the solution of problems involving different media is given.

Chapter II. of the book is devoted to the theory of electricity in motion, as distinguished from static. Here we find the definition of the measurement of the electric current, the expression of Ohm's law for homogeneous conductors and heterogeneous circuits, the electrostatic analogy and a variety of other cognate conditions, in which the flow of the current is maintained steady.

The problems involved in the variable flow of the current are treated of in the second section, which is given up principally to this form of current, to the operation of submarine and subterranean cables, signaling by condensers, and the transmission of the electric wave along submarine cables.

Chapter III. is devoted entirely to the discussion of electrical units and dimensions, the fundamental and derived units and their relation to one another.

Up to this point the work will have been more to the taste of the student of mathematics as applied to electricity, though by no means lacking in general interest; but the subsequent chapters, devoted to general physical measurements, and then their application to electrical measurement, will prove of the greatest interest to all practically engaged in electrical measurement, and who desire accuracy in their work. The author first describes the measurement of angular deflections in general, beginning with the mirror, which may now be said to be the method *par excellence*, and explains the telescope method, the adjustment, the deduction of the angle of deflection from readings, the influence of the various relations between the breadth of mirror, the diameter of the object glass and the limits of obtainable accuracy. In a similar manner he treats measurement of oscillation of torsion couples and the various methods of suspension. In Chapter V. is begun the actual discussion of electrical instruments and methods of work to which they can be applied. Naturally we find first the various forms of electrometers treated of, both absolute and non-absolute. Beginning with the Coulomb torsion balance and its method of employment for the comparison of charges, the author passes through various forms, such as the attractive discelectrometer of Harris, the guard ring attractive disc electrometer of Sir William Thomson, and the various methods of using the latter and the absolute electrometers. To these are added various forms of portable electrometers, the quadrant electrometer and the electrostatic voltmeter. All these instruments are thoroughly discussed, both as to their mode of employment and the corrections which have to be applied to their indications.

Chapter VI. takes up the subject of the comparison of resistances, and here the author passes in review the work of a large number of physicists, with a discussion of the various methods employed for that purpose, such as that of the Wheatstone bridge, the Kirchhoff slide wire, the methods employed by Matthiessen, Hockin, Carey Forster, and those of T. Gray. The comparison of resistances by the differential galvanometer and the measurement of specific resistance is also fully treated of. The question of the practical form of the standard ohm is next taken up and discussed in full. This is followed by a description of the measurement of high resistances, resistance of electrolytes, battery resistances and the measurement of the resistance of the galvanometer. The last chapter of the book is devoted to the comparison of the capacities and to the measurements of specific inductive capacity.

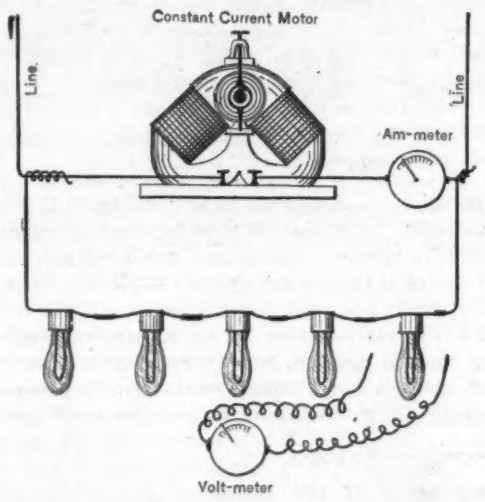
The author begins with the general process of comparing capacities and various forms of standard condensers and the various methods employed in their comparison. On the subject of the specific inductive capacity the work of the most important experimenters in this field is brought out.

The appendices to the book give the recommendation of the Paris Congress and the British Association committee as to practical electrical units, and a number of tables at the end of the book relate to the resistance, conductivity and cross section of wires of various metals; specific resistances in legal ohms of wires of different metals and alloys, and a number of other cognate subjects.

A work such as this would be impossible without the introduction of more or less mathematics into the discussion of the problems, and while the latter must naturally be the basis of a great many of the subjects treated of, the book has nevertheless been so arranged by the author, that even the non-mathematical student will find it of the greatest value and a most important help in the understanding of the subject of which it treats. As an aid to the student in the laboratory it is one of the best works which has thus far appeared. It is throughout illustrated by engravings of apparatus and diagrams which help to make the text clear, and a very full index makes the book additionally valuable for reference.

ELECTRIC ENERGY METERS. By E. Hospitalier. Paris, G. Masson, 1889. 6 × 9 in. Price, 80 cents.

This is a reprint of a series of articles which have appeared in our excellent French contemporary, *L'Electricien*, and the fact that it is from the pen of M. Hospitalier would be sufficient in itself to guarantee an interesting treatment of the subject. The author has taken up the subject in a liberal spirit, and has treated it not only comprehensively, but has entered with close accuracy into the principles underlying the principal forms and types of electric meters brought out up to date. The author classes meters generally into integrating meters and registering. The consideration of the former, of course, occupies the principal part of the work, and, according to the author's definition, integrating meters may be registering at the same time. M. Hospitalier first treats of time-counters; that is, meters which may be said to be intermediate between the charging upon a contract basis, and those which register the quantity of electricity passing through the circuit. The time meter, therefore, merely indicates the duration during which current has passed through the circuit, independent of its strength or E. M. F., and hence is, to a certain extent, available



MEASURING HIGH POTENTIALS WITH LOW-READING INSTRUMENTS.

only where the consumption is known to be practically constant during the time which it is in use. Among the apparatus described we find the counters of Aubert, Soulat, Cauderay, and that of M. Hours-Humbert. All of these are somewhat alike and are based upon the action of clockwork, which is set in operation by the passage of the current, so as to stop the clock or set it going during the time that the current passes through the circuit; or a mechanism which is set in operation and merely registers the time duration in arbitrary units indicated upon a dial.

The author next passes to meters of ampère-hours or coulombs, or quantity meters. Here we find described the various forms of the Edison chemical meters; motor meters, such as those of Ferranti, Lippmann and Siemens; the thermic meter of Forbes, and the motor meters in which alternating currents are employed, among them the Borel, the Paccaud and the Shallenberger. Under this head we find also the continuous integrating meters of Aron and Vernon Boys and the discontinuous integrating meter of Cauderay. These are followed by the description of the volt-hour meter, in which the current is maintained constant and the voltage varies. Under this head we find described the meter designed by Wright, known as the Faraday meter, which is employed in the Brighton, England, station. Finally, the author takes up the watt-hour meters, and first, those in which time is not registered, such as that of Weston, and those in which that element is brought in, among which we find the meters of Aron and Brillié.

The registering meters, which the author devotes space to in the second part, are those in which the instrument is so contrived as to trace a line on paper which is moved under a registering stylus at a uniform rate, and the curve drawn registers at every instant the current, or difference of potential, or power, expended in the circuit as an ordinate. As the author remarks, an infinite variety of these meters can be conceived, and a great many have already been brought out. He is of opinion that although they have not yet gone into general practice, they present such advantages that their general employment is only a question of time, so far as large consumers are concerned. The work ends with a short summing up of the rates and charges for electric lighting abroad, principally in England and in Paris. In the latter place we find a maximum charge of 150 centimes per kilo-watt hour.

The little work is an excellent *résumé* of the subject, and cannot fail to interest those engaged in the distribution of current, whether for light or power.

Measuring High Potentials with Low-Reading Instruments.

BY FRANK L. PERRY.

The electric light and power business is now an established fact. Motors in our larger cities and towns have ceased to be novelties, and people are daily becoming more and more familiar with the principles of electrical distribution. With this increasing knowledge there has arisen a demand for closer measurements of electric power. A "horse power" before the days of the electric motor was a variable quantity. Now when the consumer uses a constant potential motor supplied with current through a meter, he can readily and accurately ascertain the amount of power used in his establishment.

If, however, a large constant current (arc) motor has been installed it is oftentimes a disputed question between the power company and the consumer, as to the actual amount of power being furnished. This is especially the case where, with a view of adding more machinery to the plant in the future, a larger motor has been purchased than would be required at the start.

It is with a view of helping my fellow workers that I present the following description of a simple method of measuring, approximately, but close enough for practical purposes, a high E. M. F. with a low-reading voltmeter. Where the power company possesses a high-reading voltmeter, a test is a simple matter, as it is only necessary to measure the potential at the binding posts of the motor. The current being known, likewise the efficiency of the motor, the power delivered may be easily determined by calculation.

In many cases, however, the only instrument available is one reading, say, from 0 to 120 or 150 volts. This would be useless where the power of a large 10 ampère arc motor is in question. In the method described below all that is required is a voltmeter reading, say, from 0 to 120, and a few high voltage incandescent lamps.

The arrangement is as shown in the accompanying diagram. The lamps are connected in a series which is placed in shunt around the motor. Enough lamps should be in the series to prevent breakage should the potential be higher than expected, and also enough to reduce to a minimum the amount of current shunted from the motor. To make a test, measure the potential around each lamp—or each two lamps if possible—of the series with the voltmeter. The sum of these readings will be, approximately, the potential at the binding posts of the motor. In making power measurements an ammeter in series with the motor, as shown, is advisable.

While this test was found by the writer to be particularly useful in motor work, it might be applied in almost any case where a high potential is to be measured.

Mr. Hunter's Early Electrical Pursuits.

To the Editor of The Electrical World:

SIR: I was somewhat surprised to see the article of Mr. P. P. Quackenboss in your issue of March 30, 1889, page 189. As to what he says with reference to Mr. Brill I have nothing to say, but his statements relative to myself are somewhat misleading. I do not wish to enter into any discussion with Mr. Quackenboss, but will say that while it is true I was following my vocation as a patent solicitor in 1883, it is also a fact that I had been for some years previous pushing my inventions in electric railways, and of this Mr. Quackenboss was well aware, as at that time he acted for me in the endeavor to get Mr. Cyrus W. Field and others in New York interested in my electric railway inventions. Mr. Quackenboss has probably forgotten a good deal, which will account for his indefinite remarks relative to me.

R. M. HUNTER, M. E.,
Electric Car Company of America.

PHILADELPHIA, March 28, 1889.

Questions of Economy and Efficiency in Lighting.

To the Editor of The Electrical World:

SIR: Please be kind enough to answer the following through your paper: An alternating dynamo is running 500 twenty c. p. lamps, at 1,000 volts. Two hundred and fifty of the lamps are then turned off, and the difference, 50 per cent. of the current, is taken up in the rheostat to maintain the same potential, viz., 1,000 volts. What is the saving in energy required to produce the normal candle-power in the 250 lamps? C.

KNOXVILLE, Tenn.

ANSWER.—We take it for granted that the rheostat referred to is the one usually employed for controlling the strength of the field magnets of the alternating machine through the exciter. If such is the case then, strictly speaking, there is no *saving in energy*, but only 50 per cent. of the energy first required will be consumed, provided the engine, dynamo and converters, etc., are equally efficient at the two loads given.—EDS. E. W.

The New Edison Dynamo for Marine Work.

It has been the general custom in this country, on special work where slow armature speed was required, to take a standard machine of larger capacity than was required and wind it specially for the conditions imposed. This practice, however, gave a low output per pound of metal, but where weight was no particular object, there was no great objection to it. This practice has been largely due to the fact that our electrical companies had so much business of standard practice to attend to that they had no time to devote to specialties. On the other hand, in Europe, most of the work has, until quite recently, been in specialties and therefore, they have devoted more time to special dynamos, such as those required for government work, etc.

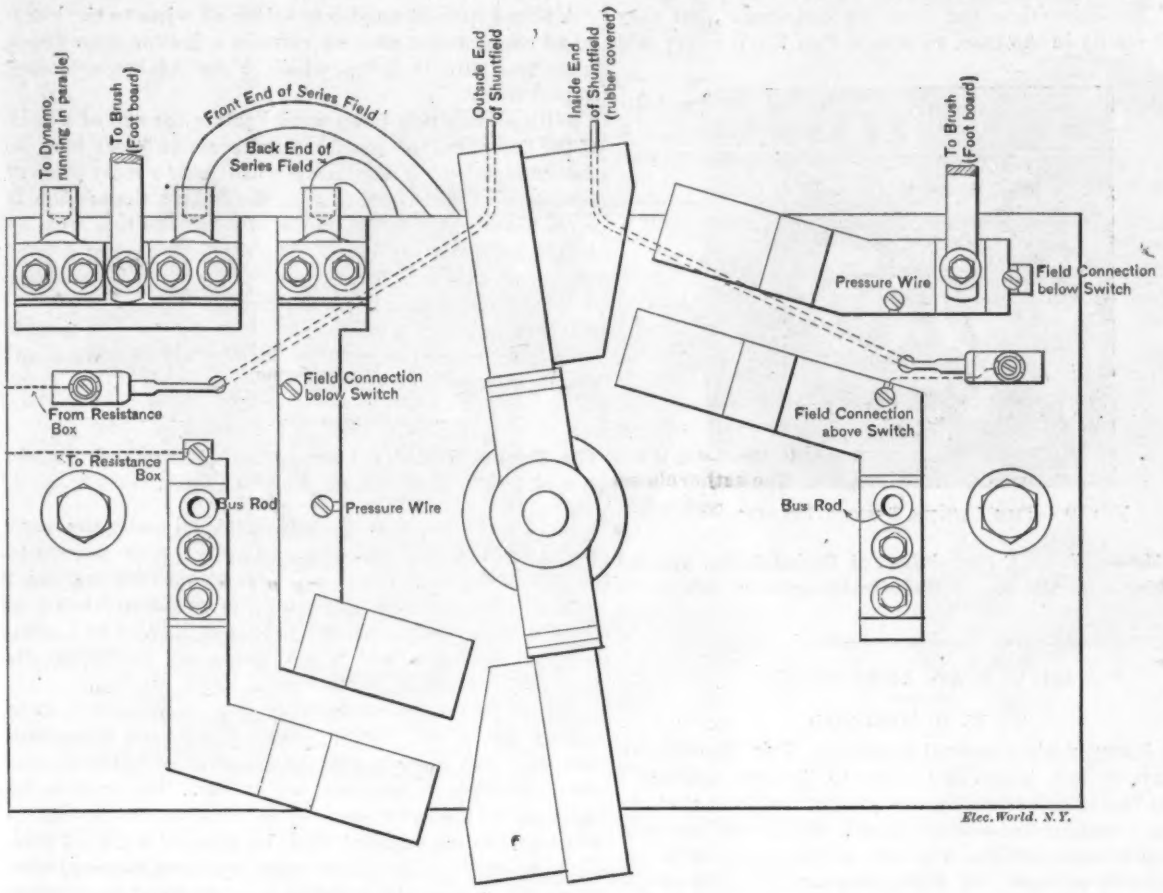


FIG. 1.—SWITCH, NEW EDISON DYNAMO FOR MARINE WORK.

Realizing the desirability of devoting proper attention to this class of work and having secured all the lighting contracts for the new navy, the Edison United Manufacturing Company, in connection with the Edison Machine Works, have designed machines specially to meet the requirements laid down by Lieut.-Commander R. B. Bradford, the Naval Inspector of Electric Lighting, to fulfil his latest ideas in regard to this matter; and also to improve upon what had been done in European navies in this line. The results obtained in Europe by these special machines have resulted in an output of from four to eight watts per pound of metal. This has been obtained, however, with an armature speed, in various cases, of from 350 to 800 revolutions, and with an increase in temperature, in the majority of cases, of from 50 to 70 degrees C. above that of the surrounding atmosphere. The specifications of Lieut.-Commander Bradford required a temperature of the dynamo after a test of one week's continuous run, of not exceeding 40° F. above the surrounding atmosphere, on either the armature or field magnets. This, of course, necessitates more weight of metal than would be the case where the higher temperature is allowed, and to this was added the condition that the maximum speed should not exceed 400 revolutions per minute. On this basis, the dynamo shown in the accompanying engraving, Fig. 2, was designed, and it has exceeded in every respect the expectations of those who had the matter in charge and has more than fulfilled the requirements of the specifications. Taking into consideration the restrictions of these specifications, it has a higher output per pound of metal than any other similar machine.

The tests recently made of these machines by the naval officers at Schenectady, Providence, and on board the cruiser "Yorktown," show some interesting results. The test at Schenectady was made to determine the general compliance with the specification of the dynamo; the test at Providence being made at the Armington & Sims engine works to test the engine and dynamo running together, and the final test of one week's continuous run being made at Cramp's shipyard, Philadelphia.

The dynamo, as will be seen, is a multipolar compound wound machine, with a Gramme ring armature, and is designed to give 100 ampères at 80 volts. The keeper is in the form of a vertical cast iron frame, from which the poles project horizontally and enclose the armature. There are eight poles, four placed over the external face of the armature and four over the internal face. The latter, however, are not placed opposite the external poles but midway between them, the poles being so located that any one section on the armature passes alternately *over* an internal pole and *under* an external. These pole pieces, eight in number, are of wrought-iron, rectangular in shape, and with the external face tapering towards their extreme end.

The field is generated by a circular coil, in the shape of a flat ring, which is inserted vertically between the two sets of poles, occupying a space between the keeper and the armature, and also between the two sets of poles, over the internal poles and inside the exterior poles. This magnet consists of both series and shunt windings, and is kept in position by small projecting lugs on the pole pieces.

The frame of the dynamos containing the magnets, etc., is electrically and magnetically insulated from the base by means of a thick sheet of fibre; the screws for holding the frame down and which have to pass through the fibre, are insulated from the frame by fibre washers and sleeves. The pillow blocks of the dynamo are separated magnetically from the cast-iron base by means of zinc plates and gun-metal bolts. The connecting coupling between dynamo and engine shafts is a flexible one, the connecting medium being a disc of leather; consequently, these shafts are also insulated from each other.

The armature is of the Gramme ring type. The ends of each section of wire are soldered into the adjacent cups of the commutator bar, and after this connection is completed each cup is connected by a wire with the three cups at right angles to it and to each other. By this method only one set of brushes is required. The commutator has 144 bars and the brushes are set at points on the circumference of the commutator, making an angle of 135 degrees with each other.

The switch board is placed on top of the dynamo and is shown in detail in Fig. 1. It has connecting points for the brush cables, compound and shunt field terminals, mains, and also for the wires joining any two dynamos to be run in multiple; it is also provided with a special double pole knife-switch.

One of the special objects gained by this switch for multiple arcing, is an extra cable connection with the second dynamo that may be running at the same time, in order to balance the load between the two machines.

The machines are provided with the new Edison pattern of self-oiling bearings, which have a reservoir of oil in the surrounding shell and require no oil cups.

The machines were tested as to regulation between full load and no load, the load varying from 100 ampères to no ampères. They showed a variation in pressure of only one volt, the speed varying during that time 1¼ per cent.

During this test the greatest heating of the field magnets was only 25 degrees C. above the surrounding atmosphere, and the armature only 19 degrees C.; in both cases below the required limit of 40 degrees F.

The weight of these machines, including the bed-plate, is about 2,000 pounds, which gives four watts to the pound. With the two hundred ampère machines which are being built for the larger cruisers, the output is five watts to the pound. The same style of machine has been designed at the Edison Machine Works. Allowing the normal heating area as employed on the special machines built in Europe for this practice they give twelve watts per pound, showing that this type of machine exceeds, under similar conditions, the output thus far obtained on any other machine.

These dynamos will all be directly connected to a special type of Armington & Sims' engines, thus giving, it is claimed, the most compact plant, both in weight and space, that has been obtained so far, and doing away with belting, which is not suitable for marine work.

These Armington & Sims' engines are specially designed to run with a steam pressure varying from 40 to 120 pounds; the low steam pressure requirement is introduced on account of the vessels lying a large part of the time in ports, and not desiring to carry high steam pressure at such time. This requirement, of course, necessitates a larger engine than would otherwise be necessary. The engine, which is double, has cylinders 7 inches in diameter by 5-inch stroke.

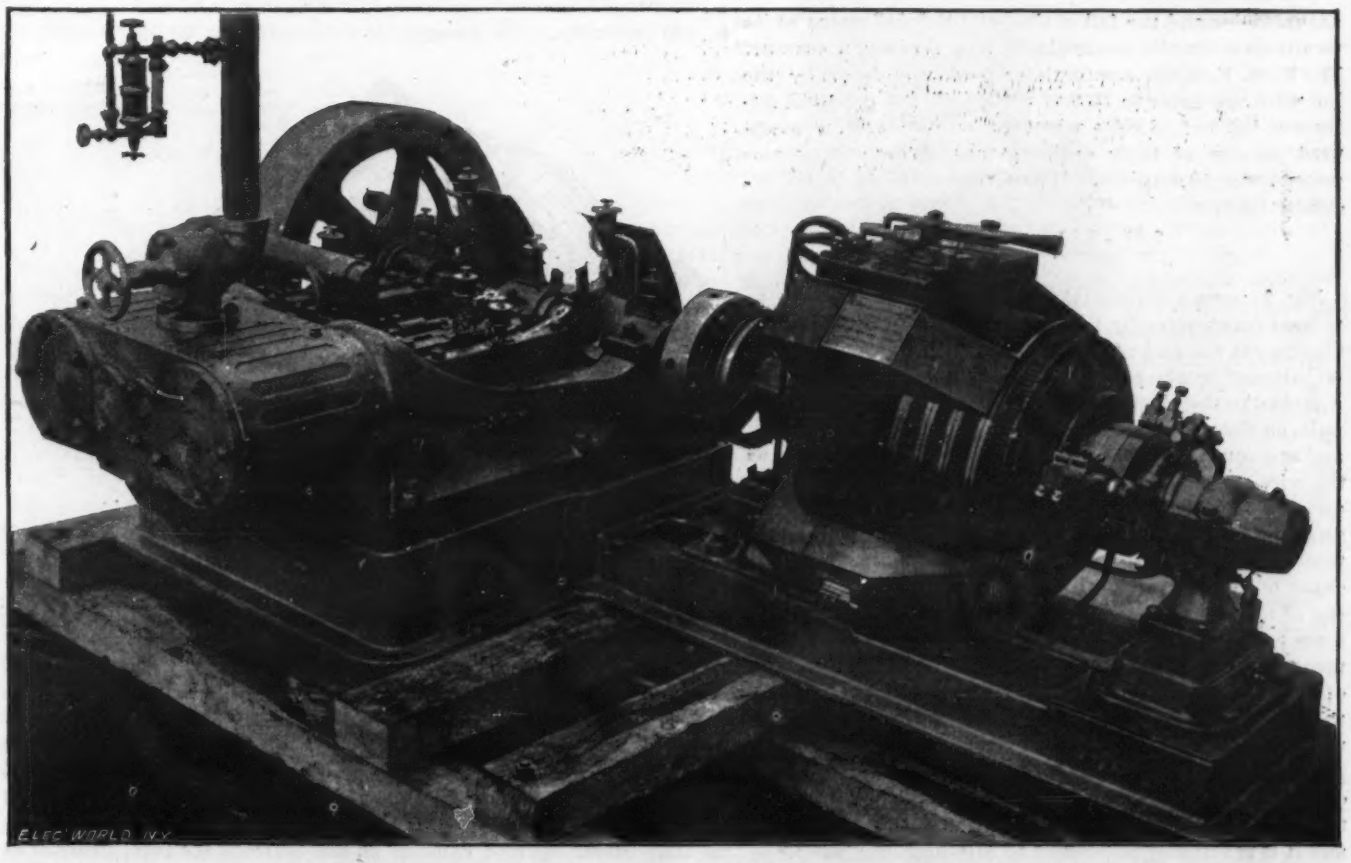


FIG. 2.—NEW EDISON SHIP DYNAMO, WITH ARMINGTON-SIMS ENGINE.

The Edison Company has, at present, completed machines of this class for the following United States vessels: the gun boats, "Yorktown," "Bennington," and "Concord"; and the cruisers "Baltimore," "Charleston," and "Pensacola."

The Lowth Stetho-Telephone.

There are probably few instruments in existence of which there is a greater variety than occur among telephones. One of the more recent of these instruments is the Lowth "stetho-telephone," which is now being placed before the public by the Lowth Stetho-Telephone Company, of Chicago, of which Mr. A. C. Knapp is general manager. This instrument is shown in perspective in our engraving, Fig. 1, and the method of its application is shown in Fig. 2. As there shown, the instrument is ready for both transmitting and receiving. It will be seen that at the lower end of the extension, lying against the throat of the operator, in the vicinity of the vocal cords, is the transmitting button, which is lightly pressed against the surface of the throat. The operator speaks, and the muscular vibrations that accompany the utterance of the words are transferred to the electrodes, through the medium of the non-electrical button, and thus articulate speech is transmitted.

By this means, it is claimed, heavier electrodes can be vibrated than is possible with the ordinary transmitter on which the air alone acts; and hence, it is claimed, greater effect is obtained in the transmitter, which also permits of the use of greater battery power. Tests of the instrument are said to have given very satisfactory results.

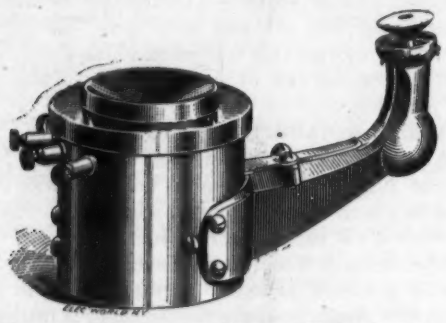


FIG. 1.—THE LOWTH STETHO-TELEPHONE.

FIG. 2.—THE LOWTH STETHO-TELEPHONE.

Ayrton and Perry's New Voltmeter.

In a paper read before the Physical Society by Professors Ayrton and Perry, the authors describe their new voltmeter for measuring low potentials, as low, indeed, as one volt, to within a hundredth of a volt. This instrument, which is shown in the accompanying illustration, Fig. 1, has been especially devised for measuring the alternate potential difference at the terminals of the secondary coil of a Thomson electric welder, which was found by experiment to be between one and two volts. It indicates up to 2.16 volts, which produces a rotation of the pointer through 360 degrees. An instrument was also shown giving the same rotation for a potential difference of eight volts.

The extreme sensibility of this type of voltmeter was demonstrated by using it to measure the E. M. F. of an accumulator and the fall of the potential difference at its terminals when the accumulator was sending a current. The E. M. F. of the accumulator used was shown by the hot wire voltmeter to be 2.07 volts, and the potential difference fell to 2.03 volts when the current sent, as measured by one of their ordinary magnifying spring ammeters, was 10 ampères. Hence the resistance of the accumulator was

$$\frac{2.07 - 2.03}{10}, \text{or } 0.004 \text{ ohm.}$$

Fig. 2 shows a horizontal section of the instrument as at present constructed by the Acme Works. In the original instrument the pull of the magnifying spring *M* was counterbalanced by the pull of the platinum-silver wire *W W* attached to the blocks *B B*, but, to save space, both these pulls on the present instrument act in the same direction, and are counterbalanced by the flat spring *M*. Hence, as the wire stretches the magnifying spring *M* is stretched, and the pointer *P P*, to which a number of fine hairs are attached to introduce damping without solid friction, rotates. The flat spring is not only introduced to enable the depth of the instrument to be diminished by twice the sag of the wire, but to enable a particular arrangement of force to be employed. In the ordinary Cardew instrument, with its two yards length of wire, the introduction of a short fuse which will melt with a current too small to damage the instrument does not seriously increase the resistance or diminish the sensibility, but in Profs. Ayrton and Perry's hot-wire voltmeter, which contains only eight inches of wire, the introduction of such a fuse would diminish the sensibility, and it is practically impossible to diminish the length of the fuse wire in proportion to the length of the working wire, as the conduction of heat by the metallic blocks, to which an extremely short length of wire is attached, prevents its melting quickly. Hence they employ a fuse, *F*, of such a diameter that it would require a far larger current to melt it than would damage the instrument, and they arrange in addition a platinum-tipped screw, *D*, so that when the wire *W W* stretches by any pre-arranged percentage beyond the amount it stretches for the maximum safe potential difference, the platinum tip *C* of the flat springs comes into contact with the screw *D*, and the working wire is short-circuited. The circuit is then temporarily completed through the lead *L* to the left, the flat spring *S* and the fuse *F*, when the current increases and the fuse melts without damage to the instrument. With this device they find that the fuse may be thick, and, therefore, have but a small resistance compared with that of the working wire, and yet the sudden application of a potential difference five or six times as great as the maximum potential difference the voltmeter is intended to measure, melts the fuse without damaging the working wires. For clearness, the fuse, the key, and the terminals *V, V*, are shown detached from the instrument, but they are in reality in the base, as seen in Fig. 1. We may add that Messrs. J. W. Queen & Co., of Philadelphia, are the sole agents for the sale of these instruments in this country.

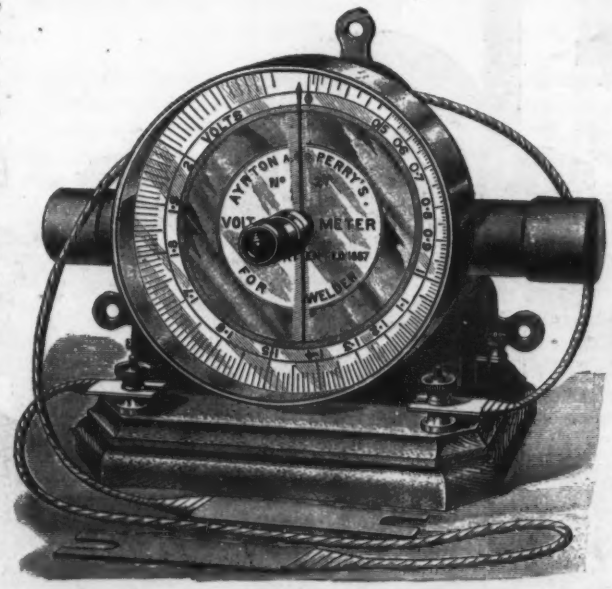


FIG. 1.—AYRTON & PERRY'S NEW VOLTMETER.

Joints in Arc Light Circuits.

BY W. H. MARKLAND.

As I have noticed several articles in THE ELECTRICAL WORLD on bad joints and hints to dynamo builders, I would like to call attention to a kind of bad joint that exists on several systems of arc lights. It appears to be the custom to screw the line wire into the binding post on the lamp board by means of a single screw, the point of the screw screwing on to wire. To my mind this is an objectionable way, for this reason: Nearly all the line wire used for arc lighting is of soft copper. Any swaying or jar of the line will, in time, cause the point of the screw to wear away the copper wire under it. This will allow the screw to work loose, thus making a bad joint or allowing the wire to come out. Of course it is the duty of lamp trimmers to see that the screws are all tight, but do they do it? I have known of cases where a magneto bell could not be rung through a joint that appeared from observation to be all right.

Several styles of lamps again are hung on hooks made of about ¼ inch diameter, of brass, the points in actual contact probably not being over $\frac{1}{16}$ inch. We thus use a No. 6 copper line wire and only allow $\frac{1}{16}$ inch for contact at the hooks. The strength of a chain is that of its weakest link. Why is this not true of an electric circuit?

Also, where a lamp board is hung rigidly and the lamp allowed to sway, there is always danger of one hook of the lamp lifting up and causing an arc between the two hooks which chars the brass or burns it badly so that it makes a bad connection. In one case in my experience after a night of very severe wind, out of 18 lamps on poles three were found on which the contact hooks had been so badly charred that it was impossible to ring a call bell through them. Dirt also accumulates between these hooks. I know of one case where a building was set on fire on account of the screws holding the wire working loose and causing an arc.

There is an easy remedy for all this trouble: Make the lamp boards in such a manner that the wire cannot work loose. If two or three screws in place of one were employed to hold each wire, part of the trouble would be avoided. Or make the connection by bending an eye at the end of the line wire and screw it to a plate of brass by means of a screw and large washer. A wire in a binding post of this kind will not work loose as soon as one in which the wire is held by a screw point screwed on to the wire. Arrangements could be made by which a flexible wire could be connected from line wire to lamp so that in case of a bad connection through the hooks another path will be provided.

A plan I have adopted is to solder all wires to the lamp-board connections; also to connect a flexible wire direct from line wire to lamp, which I find makes a decided improvement.

With all new pole-lamp work I solder the end of a piece of the best kind of insulated wire about 5 feet long to the connection on the lamp-board; also a short piece of flexible wire that I connect to the lamp. Connection is made between the 5-foot piece of wire and line wire by means of McIntire joints. The reason for using a good quality of wire is to obtain protection when it is necessary to handle the lamp while it is burning.

It may appear that there should not be any trouble from loose wires; but most people of experience with outside lighting will probably say there is.

The Burton Electric Company, of Richmond, Va., to Heat Steam Railway Cars.

The above company, recently chartered under the laws of the State of Virginia, although vested with powers to engage in a general electrical business, has been organized primarily for the development of the invention known as the "Burton electric heater." It is capitalized at a minimum of $100,000, and a maximum of $2,000,000, its principal office to be in Richmond, Va.

One of the first movements of this company will be to make a test of the Burton heater in warming steam railway cars, and already work is in progress to enable this test to be made in the next few weeks. The current for this trial is to be furnished by an Eickemeyer 80 volt, 80 ampère dynamo, supplied by J. H. Bunnell & Co., of New York, to be driven by a Brotherhood engine, supplied with steam direct from the boiler of a locomotive, an arrangement similar to that in actual use on Pullman vestibule trains for supplying current for electrically lighting the cars. For this work it is estimated that fifteen heaters, having an electrical resistance of 35 ohms each, placed under the seats, will afford ample radiating surface. With this resistance it is easy to calculate that with a dynamo of a voltage of 80, each heater will use 2¼ ampères of current, which by previous tests has been found sufficient to raise their temperature to something over 200 degrees Fahr. This temperature would be absolutely safe in case of an accident; and the fifteen heaters using only 35 ampères of current, there would be a surplus of 45 ampères to be disposed of. On the basis of this calculation it is clear that two cars could be heated with the use of 70 ampères, when there would remain still a surplus of ten ampères, which it is proposed to use in charging a storage battery during the day, to be drawn on at night for lighting the cars with incandescent lamps.

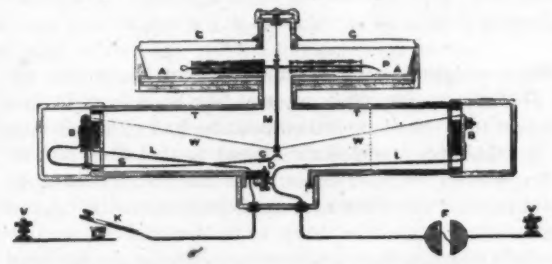


FIG. 2.—AYRTON & PERRY'S NEW VOLTMETER.

The heaters for the coming test are to be made of cast iron of the proper length to be fitted between the legs of the car seats, their tops and bottoms to be studded with radiating points, after the designs of some steam radiators. They will be supported by stout, cast-iron legs about four inches in length, which are to be bolted down to the car floor. The terminal wires of the heaters will pass through the car floor, and all the wiring will be underneath the car.

However feasible the above propositions may appear, after all comes the question of the economy of electric heating as compared with the use of steam. This the company is prepared to meet fairly and squarely; and in claiming to be able to *heat and light* one car at an expenditure of 4½ h. p. of energy, and its vast advantages over any other known method of heating as to cleanliness, safety, efficiency and indestructibility of apparatus, it is prepared to face its formidable competitor with every confidence of final victory. Moreover, *live steam* converted into the electrical work as shown here, will be always able to hold its place as against steam sent long distances, when condensation must rob it of its chief virtue, or when connections are leaky and imperfect or clumsily handled. But in no respect will the Burton electric heater, it is claimed, show its superiority over steam more than in the ease with which its temperature may be controlled; as by

the simple turning of a switch the current may be cut off from one or all the heaters as occasion may require.

These heaters were tested on the Sprague electric cars in Richmond last winter, and are now in actual operation in the offices of the Union Passenger Railway Company in that city, where they have been undergoing a three months' continual test. On these tests the calculations of the Company are based, and in undertaking its proposed work they consider that there is every reason to anticipate the most favorable results.

Latest Apparatus of the Excelsior Electric Company.

Some time ago we drew attention to the fact that Mr. Wm. Hochhausen, the electrician of the Excelsior Electric Company, was at work on the design of a series of motors, for both arc and incandescent service. Since then several machines of varying powers have been brought out by him. In the design of these motors, Mr. Hochhausen has sought to obtain the full magnetic effect of which the magnetizing coil is capable, and in order to secure this he has employed wrought iron not only in the core of the magnets, but has also retained it in the pole pieces encircling the armature. Mr. Hochhausen has come to this conclusion on a consideration of the fact that in order to obtain the same effect with a cast-iron pole piece, it would require a larger mass of iron and its increased spreading out over the surface of the armature; and, in fact, might also entail the introduction of a larger armature, either in length or in diameter, in order to obtain the same magnetic effect with a given current. Acting on this idea, therefore, Mr. Hochhausen makes his cores and pole pieces of one solid piece of wrought iron, bolting them to a cast-iron frame, which acts also as a bearing for the armature.

Our illustration, Fig. 1, shows the new 10 ampère arc motor of 10 h. p., being the largest of the series of this kind, which range from 1 up to 10 h. p. The machine is designed to run at 1,500 revolutions, and has a pulley 7 inches in diameter, and 4-inch face, with a heavy cast-iron disc which acts as a fly-wheel. The armature is wound with 4½ pounds of No. 15 wire, having a resistance of 1.04 ohm. The field magnets are wound with 130 pounds of No. 10 wire, and have a resistance of 4.06 ohms.

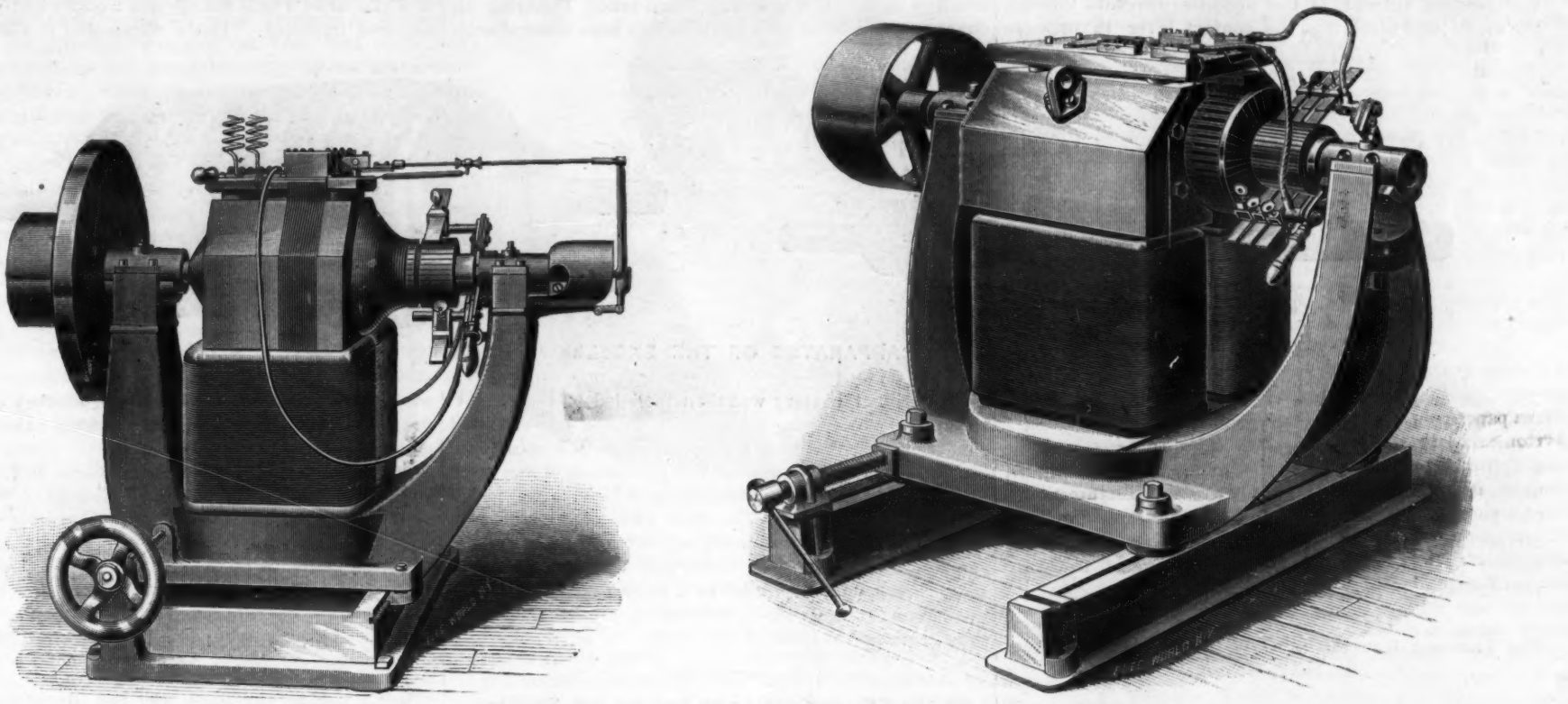
The regulation for speed is obtained by means of a centrifugal governor, which is attached to the end of the shaft and inclosed in a cap, which can be removed when it is desired to inspect the governor. The field magnets of the motor are divided up into eighteen sections, the terminals of which are brought to a series of contacts placed on top of the machine as shown. Over these contact plates there plays a slider operated by the governor from the end of the shaft, as shown, which acts to cut in or out the sections of the field magnets, and thus to vary the strength of the field in accordance with the increasing or decreasing load of the machine, thus maintaining the speed constant. The governor is very sensitive, and its only point of friction is concentrated in a ball bearing, which is kept automatically lubricated. The main bearings of the machine also are provided with special lubricating facilities.

The motor is started and stopped by means of the switch shown at the top of the machine. When starting, the switch is thrown away from the contacts, which are two in number, thus allowing the current to pass into the machine. When the machine is stopped, the switch makes contact, first, so as to short-circuit the field magnets, thus completely demagnetizing the magnets; and a further movement of the switch then short-circuits the armature. In this way all sparking is avoided. The machine is so arranged that with no load all the field magnet sections are cut out of circuit so that the armature runs practically in the field induced by its own magnetism.

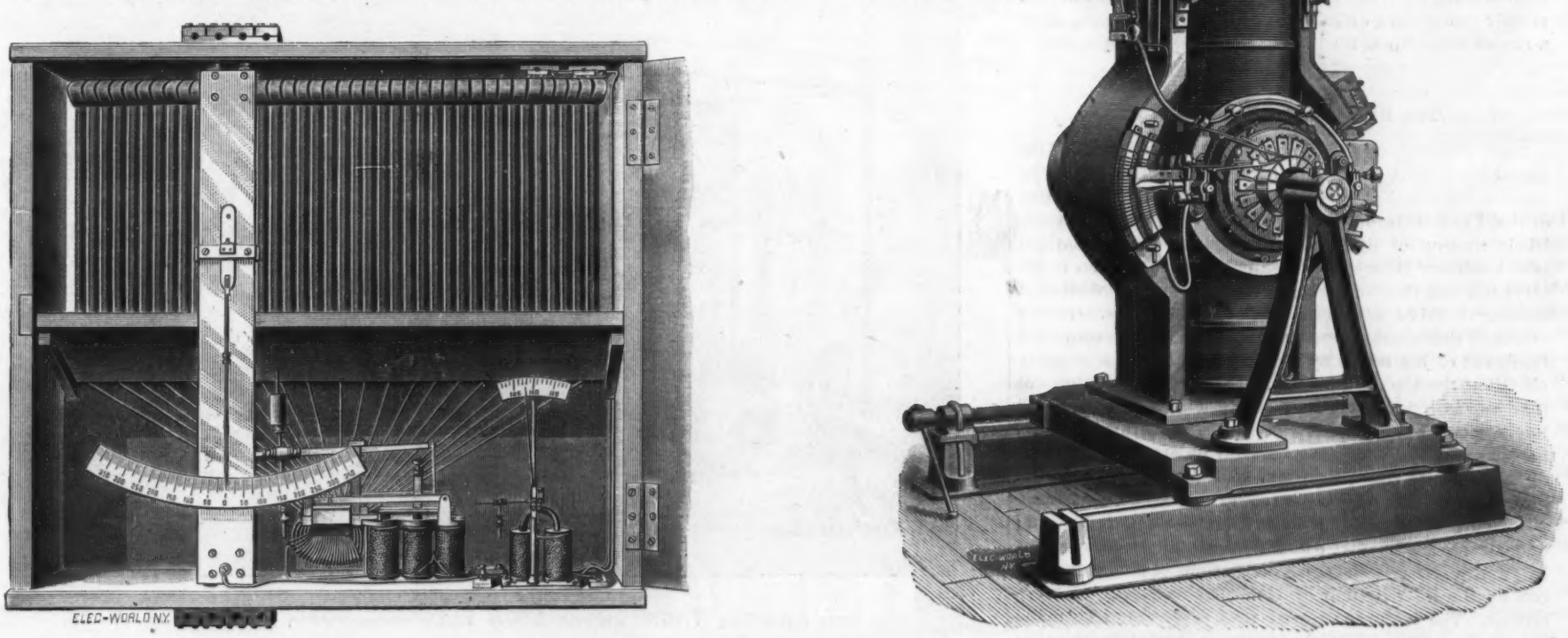
Fig. 2 represents the machine designed both as a motor and a dynamo. When used as the former, it is capable of developing 25 h. p., and when used as a dynamo, is capable of feeding 300 16-c. p. incandescent lamps. When used as a motor, the machine is wound for 220 volts and runs at 1,100 revolutions. The resistance of the armature is .09 ohm, and the field resistance is 68 ohms, the latter, of course, being in shunt with the armature and effecting therefore automatic regulation.

When the machine is used as a dynamo, where even the smallest fluctuation in electromotive force has to be avoided, a special regulator is provided. This consists of three pairs of spools, shown in the engraving, Fig. 3, in each of which play a corresponding number of cores suspended from a rocking lever. The motions of this lever are transmitted to a bar which plays over a series of contacts shown close by the spools. These contacts represent the terminals of a series of resistances consisting of carbon rods placed in the upper half of the regulator box, as shown. As the spools are placed in parallel with the lamps directly at the machine, any variation in potential will cause a raising or lowering of the cores and a cutting in and out of resistances in the shunt circuit as the machine increases or decreases in electromotive force respectively. The box also contains an ampèremeter in which the pointer traverses a scale, reading up to 400 ampères; and a volt indicator shown in the right hand lower corner of the box gives the reading of the potential at all times. The resistance of the three pairs of regulating spools is 1200 ohms, and, being subdivided into six spools, the heating is inappreciable.

Our engraving, Fig. 4, represents the Hochhausen arc light machine with its well-known method of regulation and showing clearly the operation of the machine. Our readers will remember that in this machine the current is



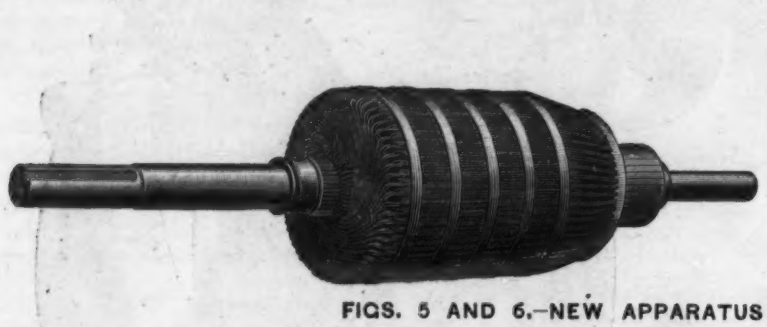
FIGS. 1 AND 2.—NEW APPARATUS OF THE EXCELSIOR COMPANY.

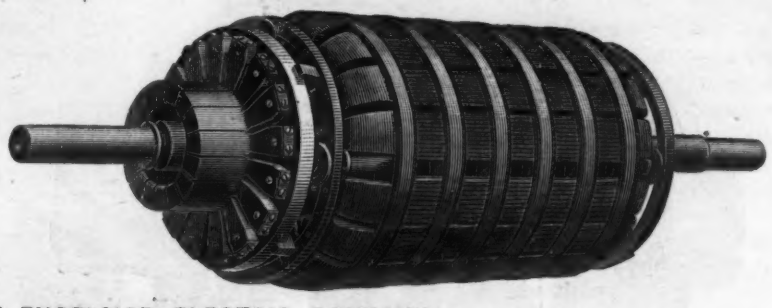


FIGS. 3 AND 4.—NEW APPARATUS OF THE EXCELSIOR ELECTRIC COMPANY.

maintained constant by cutting in or out the field sections. This is accomplished by means of a contact maker in connection with a motor, which operates the contact lever passing over the contacts with which the field sections are connected. As the current increases, a contact placed in the box on the right-hand side of the machine is so made that the motor revolves in one direction, cutting in field coils and increasing the strength of the field until the current has reached the normal strength. Upon the weakening of the current the contact is made in the other direction, sending current in the opposite direction through the motor, and revolving the contact lever in opposite direction, so as to cut out the field sections and reduce the strength of the current to the normal.

Our illustration, Fig. 5, shows the construction of the armature designed for incandescent machines and motors. These armatures have their wires wound upon forms before being applied to the drum. Fig. 6 shows the arc armature, in which the coils are wound upon a framework similar to the Gramme ring, but permitting of thorough ventilation.





FIGS. 5 AND 6.—NEW APPARATUS OF THE EXCELSIOR ELECTRIC COMPANY.

The Thomson-Houston System on West End Street Railway, Boston.

The accompanying engraving, made from a photograph, shows the method of suspending the overhead conductors on the main bridge of the West End Railway, Cambridge division, Boston. The details of the automatic switch and connecting cables were illustrated in our issue of March 9, but the present trusses were not then in position. As will be seen, there are supported from the trusses by cone insulators two short pieces of iron pipe to which the main conductor is fastened. Two frogs are placed at the abutting ends of the trolley wire which come into line when the draw swings into place and prevent the trolley from jumping the wire when it passes from the main conductor to that on the draw.

Since the road was started the operation of this part of the electrical equipment, as well as that of the remainder of the devices used in the drawbridge, and the motor cars themselves, has been of a very satisfactory nature, and reflects much credit upon the system in use. It may be mentioned here that out of the first 1,179 trips due to be made by the cars, but nine trips were lost, and this was simply due to lack of experience of the motor men. Such a record speaks well for the reliability of the apparatus.

The Discharge of a Leyden Jar.

Prof. Oliver J. Lodge lectured on this subject, at the Royal Institution on March 8, beginning the lecture by the observation that he had been led to the investigation of the Leyden jar discharge through the somewhat unlikely avenue of lightning conductors. He pointed out that Professor Henry, of Washington, was the first to observe the fact that an oscillatory discharge was capable of causing induced sparks in distant conductors. Henry observed that sparks were produced in a conductor in the basement of his house by means of sparks in a primary circuit at the top of the house. The lecturer pointed out that just as a vibrating rod, clamped at one end, could have its oscillations made slower either by increasing its length or by the addition of inertia by attaching a piece of metal to its free extremity, so the rate of oscillation of a Leyden jar discharge could be made slower by increasing its capacity or by introducing self induction; and as the mechanical oscillations could be damped out by friction, so the electrical oscillations could be damped out by the introduction of electrical resistance into the circuit. The lecturer showed that a jar could be made to overflow even when there was a complete metallic circuit between the inner and outer coatings, the connection being made through a long wire running completely round the lecture theatre. While this experiment was being shown, a number of the audience observed a spark at the side of the theatre opposite to the lecture table. On turning down the lights, sparks were observed at various parts of the wall along which the connecting wire passed, but they were not given off from the wire itself, but from the electric light wires in the building which were quite out of the circuit. This observation led the lecturer to refer to his controversy with Mr. Preece, and he observed that accidentally they had obtained a most interesting illustration of the Hertz effect of a conductor carrying an oscillatory current, and exciting electric surgings in a neighboring conductor, and these surgings were made visible by the spitting off of sparks to neighboring objects just as he had maintained was liable to occur in the case of lightning conductors.

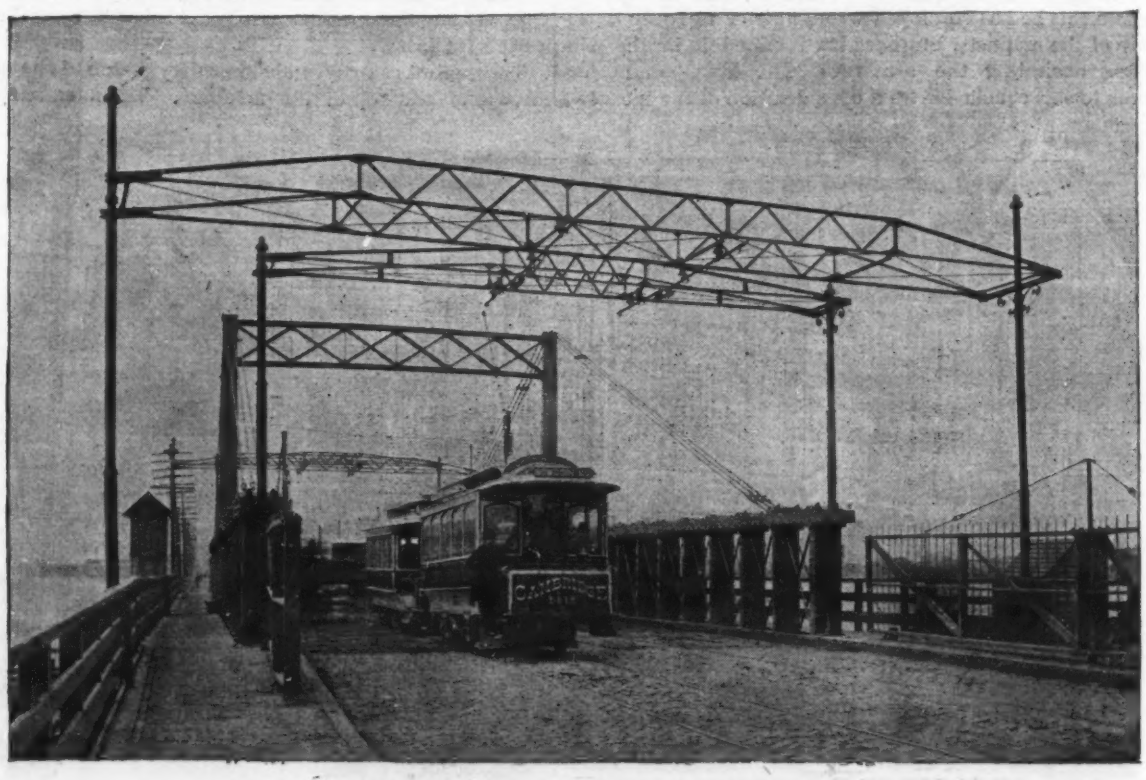
The lecturer then showed how the rate of oscillation of the Leyden jar discharge could be slowed down until the vibrations became audible to the ear. A large battery of Leyden jars was charged by means of the great Wimshurst machine belonging to the Institution, and the sharp crack of the overflow discharge was noted. A large amount of self induction was then introduced into the circuit, which had the effect of considerably modifying the nature of the overflow spark, the ordinary sharp crack changing its character, and being accompanied by a high musical note. An additional battery was then included in the circuit, thus greatly increasing the capacity, and it was observed that the spark was now accompanied by a musical note of considerably lower pitch. The production of the notes was explained as due to heat waves, which corresponded to the electrical waves. The spark giving the lowest note was then reflected in a rotating mirror, and was seen to be spread out into a serrated band, while the spark giving a sharp crack only appeared as a mere point of light in the mirror. Some other interesting experiments were shown, similar to those of Dr. Hertz.

On the Efficiency of Lamp Sockets and Switches.

BY LIEUT. H. HUTCHINS, U. S. N.

It is with a view of engaging the interest of electricians and electrical engineers in this subject that I venture a few remarks, which perhaps will be appreciated by those interested in the installation and care of electric light plants. It is well known that to insure efficiency and reliability in an electric light plant, pains must be taken to use the best material possible; and the work must be carefully done. Experience soon teaches that there are no half-way conditions—either the working of the installation will be a success and the users of the light will be ever on the increase, or else it will be a constant source of trouble, if not of danger. Hence everything that forms the material of the plant should receive due consideration. There are several manufacturers who will furnish an efficient and desirable dynamo, and the same holds true of the cables under certain limiting conditions, which conditions vary with the nature of the insulation of the conductors. As to lamps, it is doubtful if any comparative tests of them have been made in this country since the tests of the Franklin Institute. The subject of safety cut-outs and their mountings has received attention nowhere more than in England, an excellent paper on this subject being read about a year ago before the (British) Institute of Electrical Engineers. Lamp sockets and switches require their share of consideration. In regard to these I may say that the market produces some that are perfectly reliable, even when subjected to hard usage. On the other hand, there must be many electricians who can testify to the fact that some forms require occasional tinkering to keep them in working order. I doubt if there are more than a few good patterns that will stand for years without requiring examination. Again, there is sometimes a want of uniformity in manufacture. With some switches the wood swells and causes trouble; with others the springs weaken. As regards the sockets, there are certain forms of key sockets in which after a time the springs weaken and the contact becomes impaired. One's disposition is not improved when these annoyances occur, and as they can be prevented by employing the right material, pains should be taken to do so.

The approaching exposition at Paris will, no doubt, afford opportunities for electric light tests. Why should not these tests be made still more complete by a report on the efficiency and durability of lamp sockets and switches?



THE BRIDGE, THOMSON-HOUSTON ELECTRIC ROAD, CAMBRIDGE, MASS.

St. Louis Electrical Exhibition.

To the Editor of The Electrical World:

Sir: I beg to announce that the directors of the St. Louis Exposition and Music Hall Association, in accord with many influential gentlemen, are making arrangements for an extensive universal electrical exhibition, to be held at St. Louis, Mo., commencing Sept. 4, 1889, and continuing for a period of six weeks. The favor with which the idea has been received at home and abroad assures its success.

It has been decided in reference to electrical exhibits that ample accommodations shall be reserved and no charges shall be made for either power required or space occupied by exhibitors whose application shall have been received and accepted previous to April 15, 1889, as a first-class power plant (*i. e.*, 2,000 h. p., steam 1,000 h. p. engine) permanently exists in connection with the exhibition building.

In connection with the Exhibition Building also are two magnificent halls, having seating capacity of 5,000 and 1,500 respectively, one of which shall be at the exhibitors' disposal, without cost, including light, heat and service for the demonstration of electrical applications.

Evidently a universal electrical exhibition held in this central city of the United States which will be visited by substantial citizens within the territory embraced by the Atlantic and Pacific from the Canadas to the Gulf of Mexico is worthy of immediate and favorable consideration.

David J. Harris,
Room 324 Commercial Building,
612 Olive Street, St. Louis, Mo.

The Fritsche Wheel Dynamo.

In our issue of November 10, 1888, we described the multipolar disc dynamo of M. Desrozier, and in this issue we illustrate a German machine designed by Herr Fritsche and described in *Industries*, similar in some respects to that first mentioned.

In the Desrozier machine the armature conductors are of copper and arranged radially, the connection between their ends, both outside and inside, being made by segmental strips, and there is as usual a separate commutator. In all these details the Fritsche machine is different, though its principle is the same, viz., that of a disc armature without iron core revolving within a multipolar field, the lines of which are parallel to the spindle. In the Fritsche armature the conductors are of iron, to reduce the magnetic resistance of the interpolar space, and they are not placed radially, but with a certain rake, by which arrangement the segmental conductors are dispensed with. Finally, there is no separate commutator, the collection of current taking place at the outer periphery of the disc. Two successive conductors come simultaneously under the influence of two neighboring poles, and the shape of the pole pieces is so chosen that no conductor is under the influence of two poles simultaneously. The conductors or bars are arranged in two planes, one close behind the other. One set of bars rake one way and the other the opposite way, their outer and inner ends being joined by plates placed parallel with the spindle.

There are 79 bars in each set, or 158 bars in all, and the total E. M. F. is the sum of the electromotive forces induced in the 79 bars which at any moment are in series. The bars are rigidly attached, and in metallic connection with the plates at their outer and inner ends, and are not insulated. The plates are grouped so as to form rings, and are separated from each other by insulation. These rings are clamped with insulation inserted between metal rings bolted together. Fig. 1 shows a complete armature, and Fig. 2 a complete 16-pole machine arranged for belt

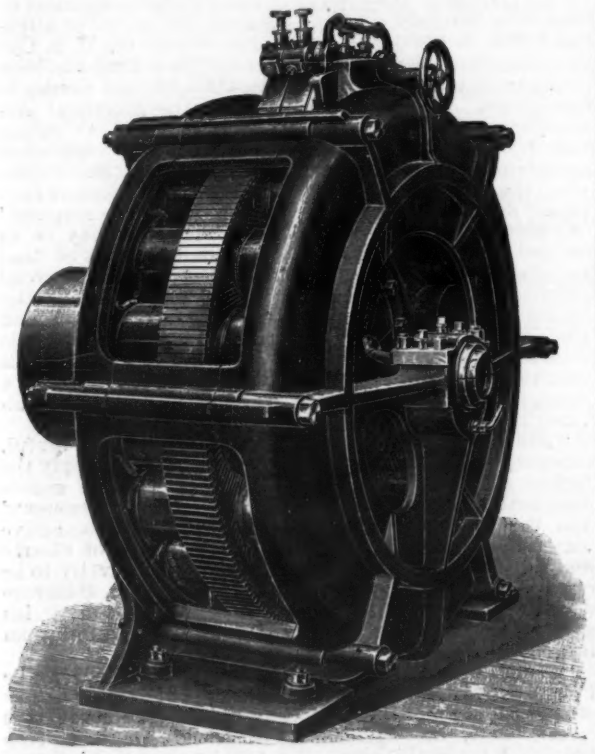


FIG. 1.—THE FRITSCHE WHEEL DYNAMO.

driving. The inventor claims that by the use of naked armature conductors, the possibility of the armature burning out under an excessive current has been entirely obviated; and that, in fact, this machine might be run with the armature conductors red hot without injuring the insulation. These machines are designed for very low speeds, and are specially intended for direct coupling with ordinary slow speed steam engines. The following table gives some particulars of the current sizes, all intended to give a pressure of 110 volts:

Speed.	Current.	Output. Watts.	Armature resistance.	Weight, cwt.	Weight per h. p.
180	50	5,500	.....	28	38. lbs.
160	85	9,400	0.060	42	33. "
160	130	14,300	0.040	50	29. "
140	200	22,000	0.025	76	26. "
140	330	26,300	0.0138	102	29. "
110	540	59,400	.....	140	175. "

Obituary—Frank Shaw.

It is with much regret that we record the death from consumption on the 23d ultimo of Mr. Frank Shaw, well known to a large number of our readers as a telegraph veteran, and as one of the pioneers in the telephonic field. Mr. Shaw was born in West Virginia in 1841, and began his telegraphic career in the construction department of the United States Military Telegraph Corps at the headquarters of the Army of the Potomac. At the end of the war he entered the services of the American Telegraph Company, and in 1867 that of the Western Union Company. He afterwards joined the Gold and Stock Telegraph Company, and in 1870 accepted the position of night inspector in the New York Fire Alarm Telegraph service. In 1872 he devoted his attention to the construction and maintenance of private telegraph lines in New York and its vicinity. This successful venture he disposed of in 1874 at a handsome profit, and devoted his time wholly to the organization of an exchange system, for the establishment of which among lawyers the Law Telegraph Company was incorporated. The plants used by the Law Company comprised dial or needle instruments and printing instru-

THE LATE FRANK SHAW.

ments. No sooner was the invention of the telephone announced than Mr. Shaw perceived its great importance and its probable value, and he at once began to study how to make the telephone of service in the exchange system. At this time he brought his work to the attention of Prof. A. G. Bell and others, and he soon obtained some telephones, which he distributed among his subscribers. At first the subscribers were practically unanimous in their preference for the dial instruments, but the trials were not abandoned. The telephone and the exchange system were gradually perfected, and at last the Law Telephone Company discarded telegraphic apparatus wholly for the telephone. To Mr. Shaw and Mr. W. A. Childs, his associate in this work, great credit is due for the development of the Law telephone exchange system, which has found a great many enthusiastic patrons and friends in New York and other large cities. The company also distinguished itself by the development and introduction of the well known Law battery, of which very large numbers have been used.

The excessive amount of work done by Mr. Shaw, while a young man, as a telegrapher and in the introduction of the telephone, made great inroads upon his strength, and during the last three years he had practically been an invalid, having in fact done little active work in the three years preceding that time. After a trip to Florida for the benefit of his health, he went to Colorado, remaining there about six months. He then returned to New York, changed his method of medical treatment, and began to improve. He declined again in health about a year ago, and since then had been mostly confined to his house. He

THE KEARNEY (NEB.) POWER STATION.

passed away at the early age of 47 years, and on March 26 was buried from his home at 102 West Fifty-sixth street, his remains being laid in Greenwood Cemetery. Mr. Shaw's wife died two years ago, and he leaves behind him a son of 19 and a daughter of 17. His death removes one of the most practical and successful telephone men in this country, one to whom a great deal of the success of the modern exchange system is undoubtedly due. The affairs of the company with which he was so closely connected remain in the hands of Mr. Childs, upon whom has rested for a long time the sole responsibility of the management.

The Kearney Power Station.

The cut on this page illustrates the new power station now being built in the city of Kearney, Neb. The station is to be built according to what is known as the "New England mill construction plan." On the outside it is of pressed brick and the inside is of heavy hardwood timber. There will be walls and flooring as nearly fire-proof as possible, a thick layer of mortar and then three inch plank flooring being used.

Upon the first floor are the engines and boilers. The story is divided first in halves by a wall running lengthwise through the building. One of these halves is then subdivided with engines on one side and boilers on the other.

Three turbines are situated on the banks of the Platte River and are connected to a main shaft running through the building. The engine and boiler rooms are two stories high. Just over the shaft room is the dynamo room. There will be an installation here of 2,000 h. p. By the construction of the building one end can be knocked out and the building extended so that 6,000 h. p. may be installed.

Although the station purports to be operated by water-power, the two engines have been set in for any emergency. They are of 500 h. p. each.

The plant is on the Edison system of distribution, and the motors are of the Sprague pattern. There are connecting with the circuits now seven motors amounting to 62½ h. p. in the city. The brick yard is also run by electricity, with an electric motor of 50 h. p. An electrical tramway is to be put in immediately with 30 h. p. motors, and several other establishments have contracted for power.

The capital stock of the company has been increased to $100,000, and the stock has all been subscribed for and taken. The work is being carried out by the Western Engineering Company, Mr. D. C. Jackson manager, which removed recently to Kearney from Lincoln.

A Tribute From Gladstone to Edison.

Mr. Edison has received from Colonel Gouraud phonograms from several English celebrities, including the Duke of Cambridge, Mr. Gladstone, the Speaker of the House of Commons, the Postmaster-General, and the Lord Mayor

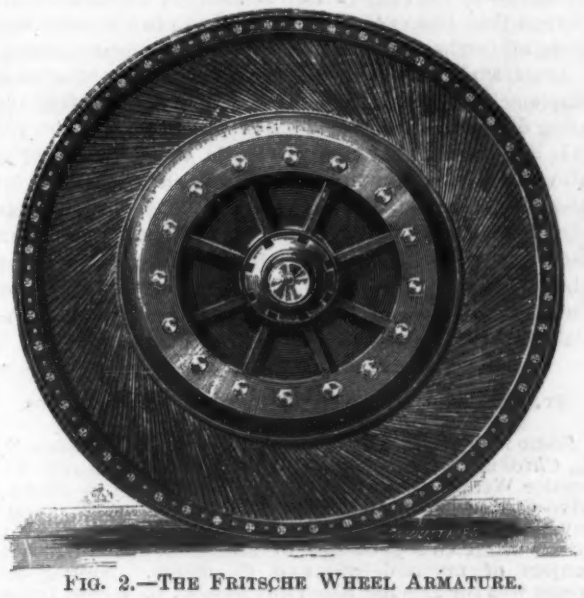


FIG. 2.—THE FRITSCHE WHEEL ARMATURE.

of London. Mr. Gladstone addressed Mr. Edison through the instrument as follows:

"DEAR MR. EDISON: I am profoundly indebted to you for, not the entertainment only, but the instruction and the marvels of one of the most remarkable evenings which it has been my privilege to enjoy. The request that you have done me the honor to make—to receive the record of my voice—is one that I cheerfully comply with so far as lies in my power, though I lament to say that the voice which I transmit to you is only the relic of an organ, the employment of which has been overstrained. Yet I offer to you as much as I possess, and so much as old age has left me, with the utmost satisfaction, as being at least a testimony to the instruction and delight that I have received from your marvelous invention. As to the future consequences, it is impossible to anticipate them. All I see is that wonders upon wonders are opening before us. Your great country is leading the way in the important work of invention. Heartily do we wish it well; and to you, as one of its greatest celebrities, allow me to offer my hearty good wishes and earnest prayers that you may live long to witness its triumphs in all that appertains to the well being of mankind.—WILLIAM EWART GLADSTONE."

A New Alloy.

A new alloy has been made by Herr Reith, of Bockenheim, Germany, which is said to practically to resist the attack of most acid and alkaline solutions. Its composition is as follows: Copper, 15 parts; tin, 2.34 parts; lead, 1.82 parts; antimony, 1 part. This alloy is, therefore, a bronze with the addition of lead and antimony. The inventor claims that it can be very advantageously used in the laboratory to replace vessels or fittings of ebonite, vulcanite or porcelain.

A New Insulating Staple for Securing Wires.

It has often been pointed out that even with the best of material employed in the erection of electric circuits, bad results may be obtained by careless workmanship; and those who are practically engaged in this work know what constant care and vigilance is required to obtain good results. One of the most fruitful sources of trouble in this class of construction work has been the necessary use of metallic staples for securing wires in position. Principal among the objections to which iron staples are open is the fact that they are apt to cut the insulation either by the immediate action of the driving blow or the subsequent gradual pressure on the compressed and somewhat flexible wrapping. As a result of this, there is apt to ensue leakage, either to ground or to the opposite pole, over the surface or through the mass of partially conducting supports, or by direct contact of the staple with a ground or a conductor. By this means also there results ingress of moisture and resulting breakage or corrosion of the copper.

The cutting or fracturing of the conductor itself may also be brought about by direct contact or pressure of the staple, and consequent reduction of its carrying capacity even to the extent of an entire rupture of the wire.

Another danger entailed by the use of iron staples is the electrolytic action set up between the copper and iron by the presence of moisture, which tends to transfer a portion of the copper through the covering and deposit for some distance around the staple. This action results in eating away the wire finally to a needle point, heating the reduced section until it melts and arcs.

In order to overcome all these difficulties the Simplex Electric Company, of Boston, have brought out a staple made entirely of insulating material. Our illustration, Fig. 1, shows some of the sizes and forms now made, the numbers indicating in hundredths of an inch the diameter of the wire each will cover. A separate driving tool is provided, shown in Fig. 2. It drives the holes into which the staple ends enter and the other end of the tool is shaped so as to encircle the top of the staple when the latter is driven home. Thus it will be seen the hammer never comes in direct contact with the staple, and no injury to the insulation is possible, as the distance to which the staple can be driven is limited by the construction of the tool, which is so arranged that the encircling arch comes to a bearing and stops all further motion when the staple is firmly seated.

Besides this preservation of the insulation, the new staple actually tends to increase it, beyond avoiding the other difficulties accompanying the use of metal.

It is needless to say that this staple can be employed in all electric construction work whether electric light, telephone or telegraph. It is also specially adapted for burglar alarm, annunciator, and all low pressure circuits within the walls of buildings, especially in basements and like places liable to moisture. The new staple will also be found of use in electrical instruments of all kinds, especially where high pressure is to be employed.

Mr. Justice Weatherbe on Hemp-Covered Cables.

Some little while ago we reproduced from the Halifax, N. S., *Chronicle* a communication to the paper, in which Mr. Justice Weatherbe, of the Supreme Court of Nova Scotia, advocated, as the result of his inquiries, the use of hemp covered cables for submarine and ocean telegraphy. The article attracted a good deal of attention, and is still the subject of much debate and discussion. Among its critics was the London *Electrical Review*, to whom Judge Weatherbe has now addressed, from Halifax, N. S., the following letter, of which he has sent us the copy, with a request for its publication:

"Ay me! what perils do environ
The man that meddles with cold iron!'

SIR: In your zeal in defending iron-armored cables in your issue of the 15th inst., you fell into an error in supposing I had addressed anything on the subject to a scientific journal.

The "high-sounding title" at which you sneer was that of the Editor of THE ELECTRICAL WORLD, of New York, to me unknown, who had warmly indorsed remarks of mine which he found in a mere provincial journal.

If you had published my language, as he did, your readers would have wondered why sarcasm so largely prevailed over science in your long article. All I asked was that no more public money should follow the millions which have been spent over rapidly decaying ocean cables *without due inquiry*. You seem to think that no such inquiry should take place. I have before me, I think, all the evidence you possess, and though I do not think much of it is of a scientific nature, I cannot admit that any other skilled knowledge is required to arrive at a conclusion than that which properly enables us to weigh the testimony. All the superiority you can claim in respect to your scientific attainments is that you are entitled to produce yourself as a witness; but you are only one witness, and much as I respect science in this case, if you cannot claim experience or skill in weighing evidence, you have little to boast of.

I have endeavored, not in vain, I think, to make myself familiar with all that has been furnished respecting the different cables you mention. The greater part of your long argument is applicable to shore ends, and not to all shore ends, but only those which are laid in exposed places, a subject not now under discussion, and which I must be permitted resolutely to insist on dismissing from consideration. That involves a question where abrasion or injury from mechanical causes is sometimes involved, in addition to chemical causes, and I think we may fairly agree to put all that out of the way for the present. This discussion relates solely to the deep sea and other undisturbed waters where corrosion is rather rapidly destroying all that remains of the iron and the contiguous core.

I am aware that much of what you describe as "birdcaging" has been discovered, but how in such cases—the result of the decay of hemp from contact with iron and from want of protection—does the core become fractured or traffic interrupted, as in the case you cite of the cable of 1860?

Will you give us instances, or aid us by scientific opinions to enable us to say how "birdcaging" should enter into the controversy?

In this view I observe you refer to the failures of the West India cables of 1870, 1871, 1872, as being not due to the iron wires, but to the nature of the bottom. This is correct if the bottom injured the wires, but if not, what on earth did produce the failures? Talking of the West Indies, I observe, parenthetically, that, according to the chairman's report for 1886, the Trinidad-Demerara cable has been again interrupted. It has been interrupted 12 times since 1879.

There is something in the mud poured from the river, which has a deleterious effect on the iron wires.

Where iron is recovered, as I admit it often is, in a perfect condition, this proves that there the ground is favorable. Where the bottom is favorable to iron it is favorable to hemp; but where unfavorable to iron it is not unfavorable to hemp. The old maxim that the strength of the chain is measured by its weakest link is applicable to the iron armor.

You speak of the *rotting* of hemp. At present I do not remember ever to have seen any trace of decay in submerged tarred Russian hemp; and you cannot, I think, suggest any possibility of injury of any kind to hemp under salt water if properly treated with a compound of pitch, silica and tar, such, for example, as Bright's compound.

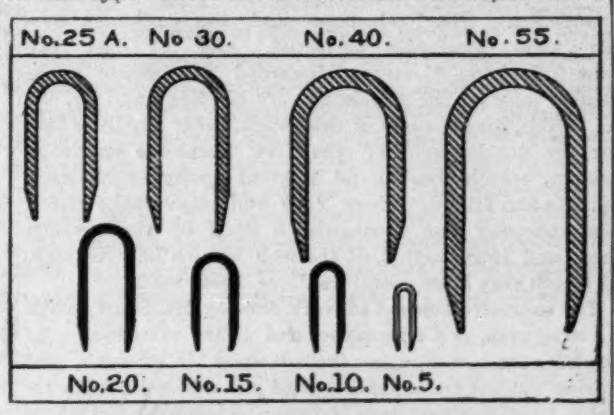
You admit you must cover your iron-armored cable, but why encase iron to go on burning up inside?

If you use hemp alone with the protection, and without the iron, there will be no chemical action to open the door to insects or other enemies.

I think the evidence strong upon which to pronounce a hempen cable practically indestructible—a cable of "perdurable toughness."

In one obscure sentence it might be inferred that you say hemp is liable to be injured by vegetable action, but I doubt if ever such a case was known. I am sure there is no vegetable in the deep sea injurious to hemp.

But yesterday one of those arguments most loudly urged against a hempen cable, which are one by one vanishing, was that it could not be sunk, but the insertion of 50 miles of this type in the Breton-St. Pierre cable has so thoroughly silenced this contention that I observe you do not even allude to it.



FIGS. 1 AND 2.—A NEW INSULATING STAPLE FOR SECURING WIRES.

The stale argument respecting the grapnel is, however, alluded to. I am astonished that you are not aware that by means of an automatic grapnel the instant of the hooking of the cable is known on board.

I do not know that you could have found this out at Jebal-Teir, but there are numbers of sailors in Halifax who could have enlightened you. Have no "dread of danger" on this score, for there is no officer on a cable ship who will now admit that he would have the slightest difficulty in bringing on board a hempen cable without the damage over which you grow quite pathetic.

I will pledge myself to produce the men, whenever required, who can even more easily raise an "unarmored" than an "armored" cable. A single practical test will settle this, and why should controversy continue? If you are as incorrect in your other assertions as you are respecting the Dartmouth cable I am to obtain little benefit from your statements. You will find upon inquiry that the bottom on which the two cables are laid is extremely rocky and the water is swarming with animal life, and the merest tyro in physical geography would not venture to set up a theory of stagnant water in such a locality. I leave you to deal with the inventors as to your statement that they have deceptively chosen the locality. You will perceive that I am not relying on this cable to advocate hemp for shore end, but if this cable can endure with absolute immunity here, how much more likely to endure "in the deep bosom of the ocean buried."

You seem to think the successful insertion of 50 miles of hempen cable in mid ocean goes for nothing. I must say it seems difficult to satisfy you. I fail to see why 500 or 1000 miles would afford stronger evidence. You are aware that it was predicted that the buoying, heaving in and all the vicissitudes attendant upon submerging a hempen cable would be fatal. I wish to inform you that on a former occasion about 80 miles of new wire cable was abandoned after it was inserted, in an attempt to repair the same cable, and the entire operation cost, that season, about *a hundred thousand pounds*.

In regard to the projected Canadian-Australian line you seem to think you can avoid very great depths. I hope you may not be disappointed. The public here in Canada would like to know what is *your* route. Mr. Sanford Fleming was the representative of Canada at the Colonial Conference in London. He was there for the sole purpose of advocating that cable.

I suppose you are familiar with his rival route in opposition to that of Field. He admits a necessary depth of 3,300 *fathoms*.

If, as you say, your close-sheathed cable is liable to be "bird-caged," what would be the situation of a company with 6,500 miles of such a frightful wreck of iron in such depths on the first casualty?

You even deny that greater speed can be obtained by abolishing iron. I do not pretend to offer data, I am in the hands of those best able to judge. In the *Electrician* of the same date on which you paid me the compliment of noticing me, I find "that it must be conceded that the absence of the iron sheath should tend to facilitate higher speed of working."

There are about 2,000 tons of iron in an Atlantic cable. Can any one doubt what would be the effect on speed of removing all this rubbish?

I remember having read in an electrical magazine, in 1882 or 1883, the report of an interesting discussion in which it was, perhaps, for the first time asserted as a striking and important discovery that torsion was the real cause of the destruction of iron cables.

I then resolved, at my leisure, to make an exhaustive inquiry into the subject. I speak now from actual experiments. Grasp firmly, so as to prevent untwisting the end, and uncoil a length of about 30 fathoms of cable, firmly lashing the end to a fixture. Now, with a file, cut into the wires, taking care not to completely sever them; they will all snap together, the cable on either side of the cutting will revolve, with more or less rapidity, in opposite directions, and the core will almost instantly be twisted asunder.

This fitly represents what Professor Tyndall calls "the slow burning of the iron which destroyed the first Atlantic cable," and which is destroying all the others. The whole story is summed up in one short word—"*resilience*."

Science teaches us how these lines are constantly becoming twisted off, as cleanly as if the sea was parted, and we could travel along the ocean bed and witness the devastation with our own eyes.

Views on the Coxe Decision as to Storage Batteries.

We are in receipt of the following from President D. H. Bates, of the Electrical Accumulator Company:

"Litigation on the subject of electrical accumulators or secondary batteries is attracting a marked degree of attention. The recent decision of Judge Coxe in the U. S. Circuit Court for the Southern District of New York has been commented upon with more or less bias by both parties to the contest. The suit was entitled the Electrical Accumulator Company vs. Julien Electric Company and William Bracken. The broad or foundation patent of the French chemist-electrician, M. Faure, was the principal patent in contest. This Faure patent describes the application of an 'active material' to a plate or support. This 'active material' may be in the form of finely divided lead, lead oxide, a salt of lead or any equivalent matter. All practical, commercial secondary batteries, as a matter of fact, are made by taking a thin sheet of lead, uniformly perforated, and applying a paste containing an oxide of lead, sulphuric acid and water. The patent, however, states that this 'active material' may be applied 'in the form of a paint, paste or cement, in the form of a deposit by galvanic action or chemical precipitation or otherwise.'

"Judge Coxe finds that it was new, novel, useful, patentable at the time of Faure's invention to apply the 'active material' to a plate or support for use in a secondary battery in the form of a 'paint, paste or cement,' and that the other methods of applying an active material, described in the patent, were either not clearly and fully described or were not of sufficient novelty to be claimed and controlled by Faure. The judge therefore decides that Faure may file a disclaimer limiting his patent to a paint, paste or cement, and may then have an injunction.

"A disclaimer is a sworn statement to be filed in the Patent Office and thereafter read as part of or explanatory of the patent; an injunction is an order of the court that certain acts, or operations described therein, stop immediately; in this case, the 'act or operation' would be the manufacture, use or sale of secondary batteries made as described.

"We understand that the Accumulator Company will file the disclaimer called for and take an injunction. They are then at liberty to institute new suits against other infringers, and, upon filing their bill, ask for an injunction as a preliminary proceeding or action on the strength of Judge Coxe's decision, and they may do this with every probability of having it granted as a matter of course.

"We understand that during the two years of litigation between these parties, the charge of infringement was never denied, and it was proved by undisputed testimony that the defendants pasted their plates. The apparent difference in the statements emanating from the two contending sources arises from the fact that the defendants claim to have recently changed their mode of manufacture and to be now applying the oxide of lead in some other form, presumably that of a dry powder, as this is the only form which can be considered without the claim of the patent as construed by Judge Coxe. The Accumulator Company state that they do not believe it is possible to make a practically successful battery by that method. If such battery should be constructed, it would be a new and experimental form; it would virtually start the manufacturer in business with a battery occupying the same position commercially which was occupied by the pasted plate battery on its first introduction in 1880 or 1881.

"The defendants have frequently stated that they have placed upon the market 10,000 cells of their battery, and it is not strange that those parties who have invested their money in these cells are apprehensive that they may be called upon either to give up their cells to be destroyed or to pay royalty to the successful litigants."

A Subway Explosion.—A great sensation was caused in New York on March 25, by an explosion in the subway at Twenty-third street and Broadway. The subway and adjoining sidewalk was badly broken. The Subway Board immediately notified the gas companies of the fact that there was a serious leakage of gas in the vicinity, which had caused the accident, and should be stopped. There are no live wires yet in the subways in question.

The Racine System of Burning Crude Oil.

As the cost of fuel is one of the heaviest items of expense in the operation of electric light stations, every method by which this can be cut down is of importance. We note the constant tendency to accomplish this in the continued improvement of the steam engines for driving dynamos, not only in their close regulating qualities but in the gradual introduction of compound engines in central stations. So also we note the care which is now bestowed on the lubrication of all the moving parts of such plants, automatic devices for continuous oiling being now considered the best practice not only for the engine but for the shafting and dynamos as well.

But there is still another factor now entering into the problem of economy in fuel, and that is the form of the same. The papers and discussions which have recently occupied the attention of the National Electric Light Association prove that the interest in the subject is keener than ever, and that oil as a fuel is destined to see a wide application in the future. Naturally the choice between coal and oil must to a large extent be a matter of local circumstances depending upon the price at which either can be furnished, taking a given amount of evaporative power as a standard. If to this be added the fa ct that the extension of pipe lines now brings the oil to very many places not formerly reached, it is not to be wondered at that the introduction of the same for fuel purposes has become a matter of serious consideration by many central station managers.

Once the saving in cost is established, the next question would naturally be the method of installing the plant so as to give the best results, both as regards economy and safety. This problem has been studied by the Racine Hardware Manufacturing Company, of Racine, Wis., and followed out in a most interesting manner.

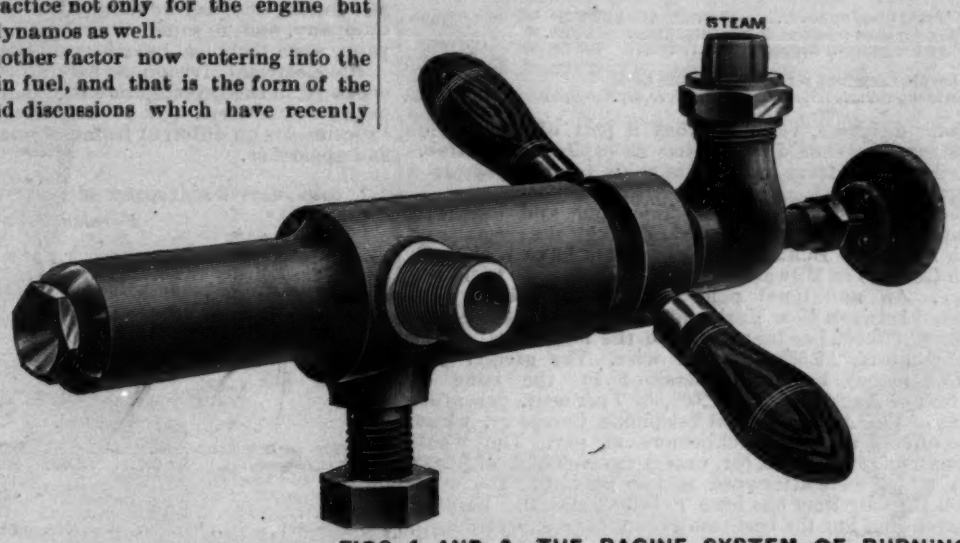
Our illustration, Fig. 3, shows the system devised by the company as applied to two factories, the boilers of which are fired by oil taken from the same supply, and showing the system of tanks, pipes, traps, etc. These details, of course, can be varied to suit different conditions, the general plan, however, remaining the same.

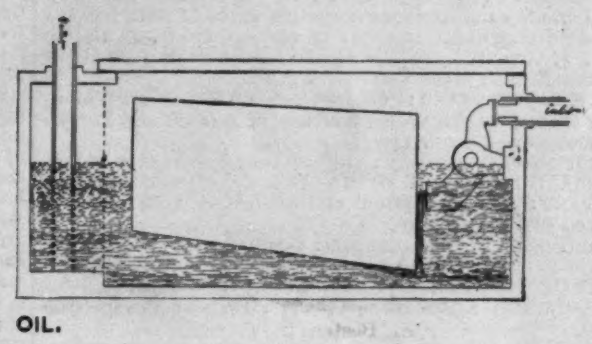
The essential features are the burner, the trap and the fuel regulator, all of which are necessary to obtain the greatest safety and economy. The "Racine" burner, shown in detail in Fig. 1, is arranged so that the size of the flame can be regulated at will by means of the steam cock shown.

An important detail of the system is the oil trap, shown in detail in Fig. 2, which is placed near the boiler and acts as a safeguard against the overflow of oil. It will be seen that when the oil level is reached, the supply is cut off by the float rising and closing the oil inlet. The outlet to the burner being above the oil level, and the oil supplied to the burner by the vacuum created, there can be no overflow. Thus, both safety and economy are provided for. Each trap is supplied with a strainer through which all the oil must pass before reaching the discharge pipe. The well, or depression, in the bottom of the trap is designed for the accumulation of sediment, which with the water accumulations, can be drawn off through a cock in the bottom of the trap. The latter is set a little below the level of the burner, and the oil is drawn up by means of the vacuum created. Should the fire from any cause be extinguished, the supply of oil ceases instantly, thus affording a safeguard against accident.

One of the most important features of the system, from the standpoint of economy, is the fuel regulator by which the consumption of oil is regulated automatically in conformity with the power required, and which maintains a constant pressure of steam in the boiler. When the pressure at which the regulator has been set is reached, it acts instantly to diminish the supply of steam and oil, and when the pressure drops, the supply will immediately increase. The regulator is connected to both the oil and steam valves, so that the supply of oil and steam are simultaneously affected by increasing pressure, and kept in proper proportions, thereby preventing a waste of fuel. The regulator being thus automatic, and the trap constructed to prevent overflow, but little attention need be given to the operation of the burner. The auxiliary boiler shown in connection with each main boiler in Fig. 1, is a special feature of the "Racine" oil burning system. It is provided with a small hand air pump with which to supply the atomizer with air, instead of steam, at first firing. After five or ten minutes, sufficient steam will be generated to dispense with the air pump. In fifteen minutes the auxiliary boiler will furnish sufficient steam for the burner in the large boiler, and when the large boiler has generated sufficient steam to supply its own burner, the auxiliary can be shut down till the next time of firing. In cases where steam is kept up continuously in one or more boilers of a battery, the steam supply for first starting can be taken from them and the auxiliary dispensed with.

The illustration Fig. 3 shows the plant as actually in operation at the works of the company at Racine, and it will be noted that two sub-tanks are employed, one for each boiler. This is necessary only when the reservoir does not give sufficient head. The pump shown in connection with the main supply tank is employed only for filling the sub tanks and for filling the reservoir from the car when the tank on the track does not give sufficient head. To prevent still further all danger from fire the vent pipe passing out of the tank has its opening covered with a wire gauze on the principle of the miner's safety lamp.





FIGS. 1 AND 2.—THE RACINE SYSTEM OF BURNING OIL.

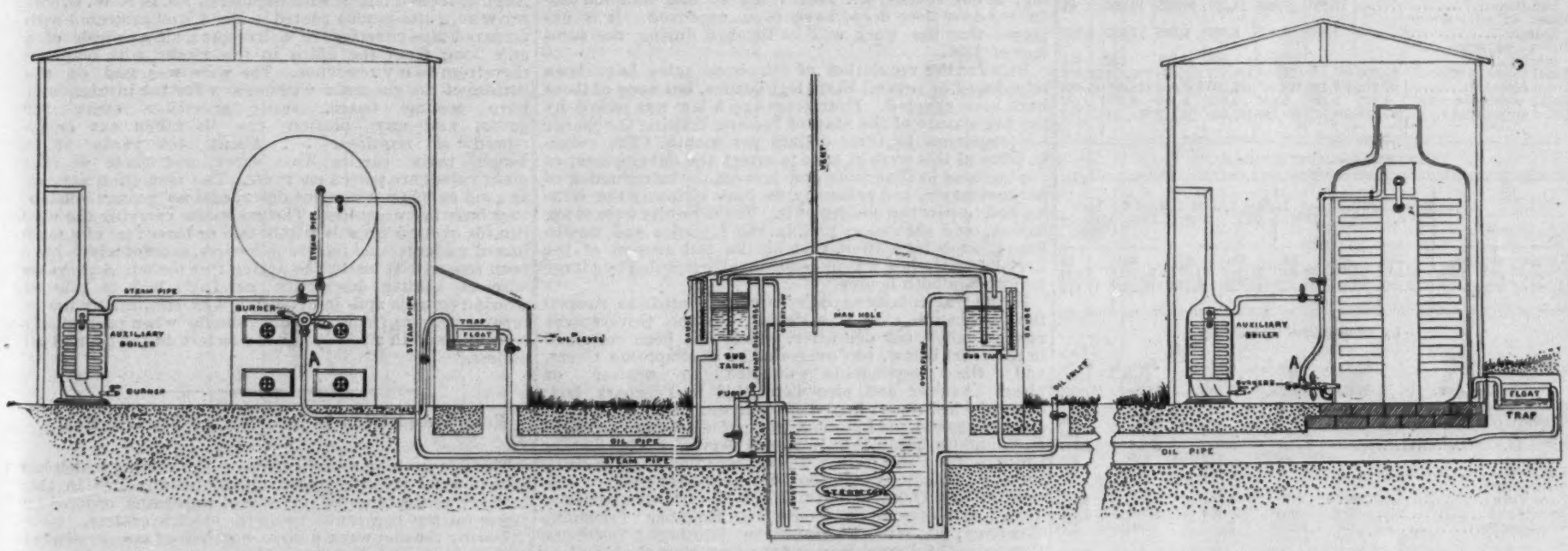


FIG. 3.—THE RACINE SYSTEM OF BURNING OIL.

Electrosentience—The Coming Sense.

BY REGINALD A. FESSENDEN.

The alarm felt by the public about the effects of electricity cannot be caused by the danger which any individual citizen incurs, for gas is killing hundreds where electricity kills one. The reason is that gas is something more or less under the individual's control, and when a leak occurs it can be perceived by the senses. An electric leak may occur blocks away, and there is, moreover, no sense to warn us of it. We have touch to determine the limits and surface of bodies; taste, their chemical action; smell, the effect of the small particles they throw off; sound, the wave movements of the air; and sight, the waves of the ether; but we lack a sense that shall tell us when our hand is in a dielectric and approaching a conductor. Evolution has brought us many things, and it cannot be doubted that it will bring us this also; but till our nerves have been educated so that they are capable of perceiving etheric vortices, the electric current will always remain more or less of a mystery that provokes awe and fear.

The New "Tobin" Bronze.

Among the new metals which have recently come into use in the construction of electrical apparatus is the "Tobin" bronze made by the Ansonia Brass and Copper Company. This metal when rolled out is remarkable for its high elastic limit, tensile strength, toughness and uniform texture, and is stronger than ordinary mild steel rods or plates. The tensile strength of six Tobin bronze one-inch round rolled rods, turned down to a diameter of ⅛ of an inch, tested by Fairbanks, averaged 79,600 pounds per square inch, and the elastic limit obtained on three specimens averaged 54,257 pounds per square inch.

At a dead red heat Tobin bronze can be forged and stamped as readily as steel. Bolts and nuts can be forged from it, either by hand or by machinery, with a marked degree of economy. Another important feature in the working of this metal at a dark red heat is, that it can be drop-forged in the same manner as steel, either from solid rods, sheets or bars. It has a specific gravity of 8.071, while the specific gravity of rolled copper bolts of a tensile strength of 33,000 pounds per square inch is 8.7.

The weight of a cubic inch of Tobin bronze and copper is respectively .2800 and .3146 of a pound, a difference of .0346 of a pound in favor of the Tobin bronze. This very important feature of lightness, in addition to its great tensile strength and resistance to corrosive action, makes it specially adapted to electrical work. When rolled into sheets and tempered it makes an excellent spring metal for electrical apparatus. When drawn into wire it has great tensile strength, toughness and elasticity.

The breaking strain per square inch of No. 14, B. & S. gauge, diameter .064 of an inch, is 130,416 pounds; No. 8, B. & S. gauge, diameter .1285 of an inch, is 112,100 pounds No. 4, B. & S. gauge, diameter .2043, is 108,896 pounds.

Johns Hopkins University Notes.

The experiments performed by Prof. Rowland, in the Helmholtz laboratory, on the deflection of a suspended needle by a static charge of electricity in motion, are being repeated here with a view of obtaining quantitative results. The work of eliminating errors is, of course, extremely great, but the results so far obtained are encouraging, and lead one to believe that ere long our knowledge of the phenomena will be greatly increased by valuable quantitative measurements.

Mr. Henry H. Weigand, of the Johns Hopkins University, on the evening of March 25, delivered the first lecture of a course of instruction in the principles and practice of electricity. The class which is designed to meet the wants of those whose vocation brings them daily in contact with the practical applications of electricity, is held twice a week in the physical lecture room of one of the prominent city academies, where a fine collection of apparatus will furnish the instruments necessary for the experiments which are to illustrate the course.

The many leading electrical firms throughout the United States, besides others personally interested in exact electrical measurements, are now showing their appreciation of the effort made by the Johns Hopkins University to secure greater uniformity and accuracy in all electrical measurements, by the frequent demands made of late for the standardizing of instruments of various kinds, insulation tests, etc., as the résumé of the recent work done at the Testing Bureau given below will show.

U. S. Government: Comparison of Sir. Wm. Thomson's ammeters and voltmeters, and of Ayrton and Perry's voltmeters and ammeters.

Professor Chandler: Calibration of resistance boxes.

India Rubber and Gutta Percha Manufacturing Company: Determination of insulation resistance of various samples of wire.

The Edison Manufacturing Company: Insulation resistance.

The Okonite Company: Insulation resistance.

Woodward Electric Company: Tests of storage batteries.

The E. S. Greeley & Co.: Calibration of various resistances and standard coils.

Also, various determinations of insulation, calculations for electrical systems, etc. R. B. O.

Annual Report of The American Bell Telephone Company.

Subjoined is the report presented by President Howard Stockton on March 26:

The reports of the fifty licensed telephone companies within the United States show in general a steady increase of business and a conservative management of affairs. It has been our aim to use the influence of the American Bell Telephone Company to encourage liberal expenditure for the improvement and extension of plant and for the bettering of the service.

The consolidated statistics are given in the following tables:

EXCHANGES.

	1884.	1885.	1886.	1887.	1888.	1889.	Inc. over 1888.
Exchanges	906	772	774	736	739	742	3
Branch offices	419	481	428	446	452	452	.....
Miles of wire on poles	.....	88,481	100,332	111,349	127,839	142,631	14,792
Miles of wire on buildings	.....	11,886	10,043	10,587	10,225	10,266	41
Miles of wire under ground	.....	1,225	3,417	6,030	8,009	17,038	9,029
Miles of wire submarine	.....	.....	254	265	365	536	171
Total miles of wire	85,896	101,592	114,046	128,231	146,438	170,471	24,033
Total circuits	97,422	107,440	112,067	121,260	132,004	143,687	11,683
Total employés	4,762	5,168	5,438	5,843	6,183	6,310	127
Total subscribers	123,625	134,847	137,750	147,068	158,712	171, 54	12,742

EXTRA-TERRITORIAL LINES.

	Jan. 1, 1884.	Jan. 1, 1885.	Jan. 1, 1886.	Jan. 1, 1887.	Jan. 1, 1888.	Jan. 1, 1889.	Inc. during 1888.
Number of lines	508	826	897	911	927	947	20
Miles of pole lines	20,592	25,768	30 697	31,143	32,478	34,010	1,532
Miles of wire	29,359	35,631	41,745	43,767	56,179	73,293	17,114

UNDERGROUND WIRES.

Exchanges.	Jan. 1, 1886. Miles.	Jan. 1, 1887. Miles.	Jan. 1, 1888. Miles.	Jan. 1, 1889. Miles	Inc. over 1888. Miles.
Albany	....	1	1	1	....
Boston	289	347	736	1,580	844
Brooklyn	134	1,233	1,443	2,197	754
Chicago	760	1,462	2,000	3,127	1,127
Detroit	....	82	175	500	325
Louisville	....	9	238	469	231
Milwaukee	1	1	....	....	....
New York	627	627	1,120	5,203	4,083
Pittsburgh	614	966	958	2,370	1,412
Washington	992	1,302	1,338	1,591	253
	3,417	6,030	8,009	17,038	9,029
American Telephone and Telegraph Company's long distance wires	....	....	140	327	187
Total	....	....	8,149	17,365	9,216

INSTRUMENTS.

	Dec. 20, 1884.	Dec. 20, 1885.	Dec. 20, 1886.	Dec. 20, 1887.	Dec. 20, 1888.	Increase during the year.
In the hands of licensees under rental	325,574	330,040	353,518	380,277	411,511	31,234

EXCHANGE CONNECTIONS.

The estimated number of exchange connections daily in the United States is	1,051,506
Or a total per year of	383,821,590
The number of daily calls per subscriber varies in different exchanges from 3 to 14, the average throughout the United States being	5 13-100

The average cost to the subscriber varies according to the size of the exchange and character of the service, from 2 to 8 cents per connection.

EXTRA-TERRITORIAL CONNECTIONS.

The average daily number of extra-territorial connections is	7,222
Or a total per year of	2,636,030
The extra-territorial earnings for the year amounted to	$771,734.28
Of which this company's share is	79,792.67
An increase over 1887 of	3,716.31

It will be seen that the net output of instruments under rental was 31,234, an increase of 4,475 over 1887, and the largest number since 1883.

The mileage of wire is 243,764 as against 201,911 in 1887. Many of the local companies are replacing iron wire with copper for extra-territorial work.

The statement of the Treasurer shows that the gross earnings for the year were		$3,865,118.48
Expenses		1,450,913.26
Net earnings		$2,414,205.22
Miscellaneous credits		22,258.34
Total		$2,436,463.56
Regular dividends paid	$1,192,152.00	
Extra dividend paid	597,726.00	
Total dividends	$1,789,878.00	
Reserve for depreciation of instruments	46,585.56	
Reserve for general depreciation	600,000.00	
		$2,436,463.56
The surplus account remains the same as it was last year		$2,028,035.92

Your directors, believing that a part of the income from royalties should be treated as capital, have transferred $600,000 from the net surplus for the year to a reserve account.

The lines of the American Telephone and Telegraph Company have been extended during the year 1888 from Albany to Buffalo, and new lines have been built from Chicago to Milwaukee, and from Boston to Providence. An additional pole line has also been constructed between New York and New Haven. Altogether about $2,200,000 has been spent on the long lines, which now comprise 26,038 miles of wire. The greater part of this money has been obtained by the issue on the first of August last of $2,000,000 7 per cent. debenture bonds of the American Bell Telephone Company, which were offered to the stockholders at par. The whole amount was subscribed for, except twelve bonds of $1,000 each which were afterward sold at auction. The service on the long lines has been excellent and the business is increasing, but the best results cannot be expected until the principal exchanges shall have adopted the metallic circuit system; exchange subscribers in the cities connected by the long lines will then be able to converse directly through their exchange instruments. Besides the direct profit from the long lines there have been important indirect advantages resulting from their construction. Wherever they have been built, the local companies have adopted a higher standard of construction and service, and their extra-territorial tolls have greatly increased. The success of the long lines has convinced your directors that the system should be extended. To provide money for the work and for other contingencies, the Legislature has been asked to authorize an increase in the capital stock of the American Bell Telephone Company. The advantage to the public of the proposed development and extension is so plain that we hope it will be generally approved.

The telephone business in Boston now requires a great deal of office room. The New England company in particular is about to construct a switch-board, adapted to either metallic circuits or single lines, and it is of great importance that it should have a suitable floor in a fireproof building arranged with special regard to its needs. The American Telephone and Telegraph Company must also have a place for its cables and switch-board and a public office. The difficulty of finding suitable accommodations for these various purposes led your directors to authorize the construction of a building. The southwest corner of Milk and Oliver streets was bought, and the plans of Mr. Carl Fehmer for a nine story fire-proof building, about seventy-six feet front by one hundred and twenty-two feet deep, have been approved. It is expected that the work will be finished during the summer of 1890.

Bills for the regulation of telephone rates have been introduced in several State legislatures, but none of them have been enacted. Four years ago a law was passed by the Legislature of the State of Indiana limiting the charge for telephones to three dollars per month. The consequences of this were at once to arrest the development of the business in that State and prevent the introduction of improvements, and presently to limit seriously the service and impair the quality of it. These results were so apparent, and showed so plainly the injustice and unwisdom of such legislation, that at the last session of the Legislature the law was unconditionally repealed by a large majority in both houses.

In the "Telephone appeals" a motion made to re-open the Drawbaugh case was denied. In the Government case, so called, our demurrer, which had been sustained in the court below, was overruled by the Supreme Court, and the respondents directed to answer or plead. Answer and plea were filed in February last. Since the last report final decrees in our favor have been entered against the following companies; American Cushman, and Cushman Telephone and Service Companies, at Chicago; the Pan Electric Telephone Company, at Baltimore; its branch, the National Improved Telephone Company of New Orleans; and five Pan Electric Companies in Texas, and one in St. Louis; the Emmner Telephone Company, of West Virginia; the Southern Telephone Company, of Little Rock, Arkansas, and the Wallace Company, of New York. On Dec. 30, 1886, Elisha Gray filed with the Commissioner of Patents a motion and request, alleging fraudulent proceedings in the Patent Office in the prosecution of the Bell application and with relation to the Gray caveat, and alleged that in the prosecution and the trial of the interference there was collusion, because the applications of several of the parties were owned and held in the interest of the Bell company, and that he had discovered new and important evidence touching all of said matters. On these and other grounds he asked that the decisions in said interferences be set aside and the interferences reopened. On March 2, 1887, James W. McDonough filed a similar motion and request, setting forth the same and other grounds for it. Thereupon, beginning Feb. 1, 1888, the two motions were argued before the commissioner in person, the trial and arguments lasting eight days. The parties introduced as new evidence all the evidence laid before the Department of the Interior in October and November, 1885, on which the government suit was ordered, and also other proofs. The examiner gave the case a very exhaustive examination, and on Feb. 23, 1889, gave a written opinion, deciding that all of the proceedings in the patent office were just, lawful, right and proper; that there was no fraud therein; that there was no fraud or collusion in the prosecution, trial, or decision of those interferences; and that the decisions therein were right and should be respected, and denied both of the motions on their merits.

The mechanical department has been removed to larger and more convenient quarters. This has been made necessary by the greatly increased work of this department during the year. It is believed that the increased facilities afforded by the new quarters will assist greatly in the work of experimentation on the subjects which present themselves, and towards a solution of the new problems which are constantly arising.

The patent division has pushed forward its work of digesting information upon electrical subjects, in addition to its regular work of reporting upon the various questions submitted to it by officers of the company. It has also during the year advised with the Western Electric Company, and, to some extent, with the Canadian Company, upon technical questions submitted by them.

The electrical division, as heretofore, has been largely occupied in the investigation of technical matters for the use of our counsel. It is also conducting a series of experiments on different forms of telephonic instruments and apparatus.

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

	1887.	1888.
Earnings.		
Rental of telephones	$2,264,823.94	$2,453,279.34
Dividends	1,013,036.99	1,213,856.58
Extra-territoria and branch lines	80,443.67	78,711.18
Telegraph commission	19,962.31	21,164.92
Interest	70,235.68	90,466.65
Miscellaneous	4,525.11	7,639.81
	$3,453,027.70	$3,865,118.48
Expenses.		
Expenses of operation	$242,205.06	$274,442.00
Legal expenses	207,679.95	222,257.75
Interest and taxes	139,174.80	207,212.68
Commission	433,578.37	467,471.10
Royalty	11,000.00	10,000.00
Concessions	189,765.38	207,790.27
Miscellaneous	19,027.33	61,739.46
	$1,242,430.89	$1,450,913.26
Net earnings	$2,210,596.81	$2,414,205.22
Misc. items to surplus account	27,011.31	22,258.34
	$2,237,608.12	$2,436,463.56
Surplus account, Dec. 31, 1887	$2,028,035.92	
Net earnings, 1888	2,414,205.22	
Miscellaneous items	22,258.34	
		$4,464,499.48
Regular dividends in 1888	$1,192,152.00	
Extra dividend in 1888	597,726.00	
Reserve for general depreciation	600,000.00	
Reserve for depreciation of inst's	46,585.56	
		2,436,463.56
Surplus account, Dec. 31, 1888		$2,028,035.92

Gas Mains as Electrical Conduits.

Mr. P. H. Wilkinson, of Harrogate, writes to the London *Journal of Gas Lighting*, as follows: "I notice that, in an extract from The Electrical World a claim for having in 'the first instance' applied a telephonic wire in gas mains is attributed to New York for work done about four years ago. Upwards of five years since—viz., in August, 1883—I laid down a number of No. 16 B. W. G. copper wire, gutta-percha coated to No. 4, and protected with prepared tape covering, in a live gas main upwards of a mile long from the office to the works, with branches therefrom to my residence. The wire was laid on the bottom of the gas-main without any further insulation. I have testing boxes, easily accessible every 250 yards, and any portion can be taken out or renewed if required. . . About 400 yards of a 2-inch main carries two wires, and three or four main valves are passed *en route*. The insulation appears as good as when it was put down, and no repairs whatsoever have been required. The gas mains carrying the wire run for about 500 yards within two or three feet of a main line of underground telegraphic wires, some of which have been renewed at least once during this period. A previous wire of similar description, carefully laid in pitched wooden troughs and in good soil, was continually under repair, and was frequently unavailable when particularly required; and in a few years it was left in the ground as useless."

Recent Additions to the Sprague Electric Roads.

There is nothing so indicative of the success which has attended the electric street railway installations in this country as the repeated increase of apparatus ordered by street railway companies using the electric system.

During the last week a large number of street railways operated upon the SpragueElectric Railway system have ordered an additional number of cars in view of the increased traffic during the summer months which is expected by many of them. Among the railways which have ordered additional equipments are those at St. Joseph, Harrisburg, and Wilmington. These railroads have already ordered one set of additional cars, and this order makes the third received by the Sprague Company in each of these cases for more cars. The representatives of all these companies have written to the Sprague Company expressing satisfaction with the operation of their roads. The East Reading & Black Bear Railroad, which has been operating for only two and a half months has proved to be so great a success, that the directors of the road have ordered an additional number of cars, In St. Joseph, Mo., where there are two electric railways on the Sprague system, the Union Passenger Electric Railway and the Wyatt Park Electric Railway, both of these companies have ordered an additional number of cars to accommodate the anticipated traffic. The additional equipments of the Wyatt Park line call for four new Sprague cars, and the additional equipment ordered by the Union Passenger Railway also include four cars with dynamo and station appliances. The factory of the Sprague Electric Railway and Motor Company is now working to its fullest capacity to supply these large orders and to fill the new contracts which have been sent in during the last month.

The Worthington Independent Condenser.

In order to meet the special requirements for a condensing apparatus to be used in connection with high speed engines for electric lighting, the firm of Henry R. Worthington, of this city, has recently brought out an independent condenser which possesses some marked advantages. Our illustration, Fig. 1, shows the condenser in perspective, and Fig. 2 shows its arrangement as installed in an electric light plant consisting of two high-speed engines of well-known build, upon which a vacuum is maintained by one of these independent condensers. The condenser is located below the level of the engine-room floor, to bring the lift of the injection water within the prescribed limit of 20 feet, and the exhaust pipes from the engines lead to an exhaust trunk to which the condenser is attached. When an engine is stopped, it is shut off from the exhaust trunk by a gate valve in its exhaust pipe. In large plants it is well to divide the engines into groups, and use two or more condensers, putting those engines which have about the same time of running, in the same group.

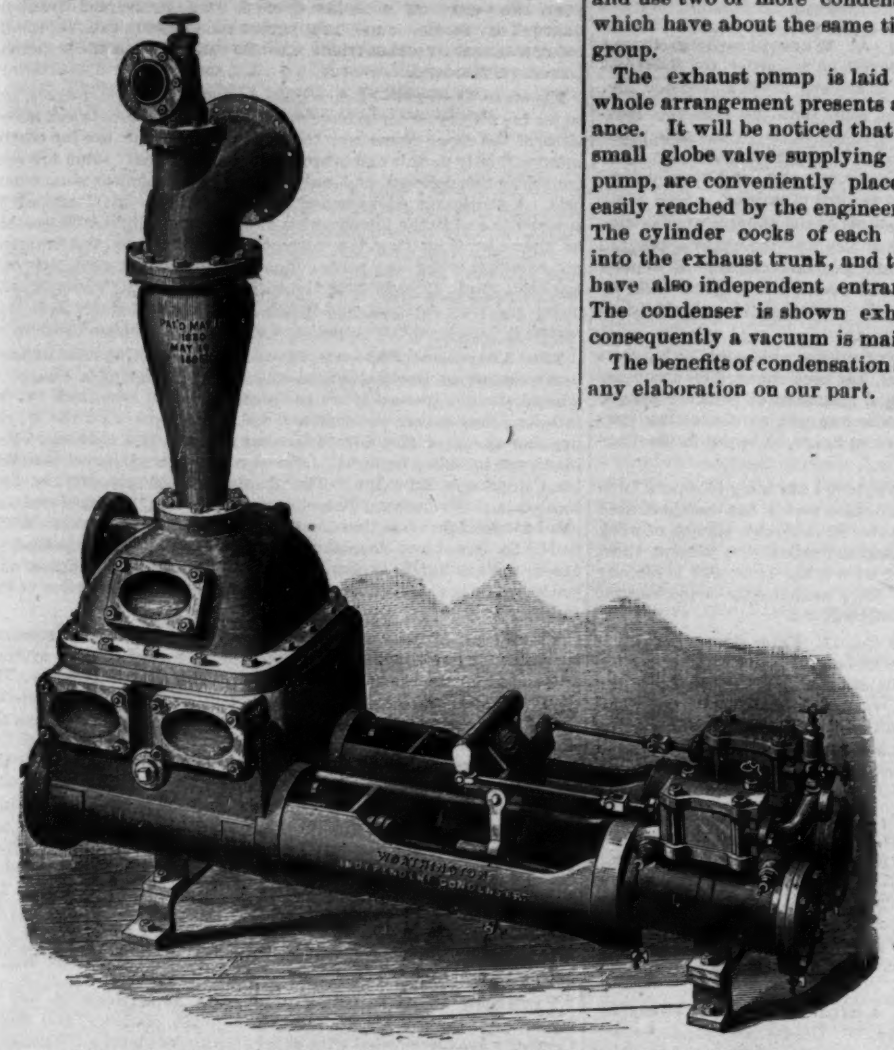


FIG. 1.—THE WORTHINGTON INDEPENDENT CONDENSER.

The exhaust pump is laid below the flooring, and the whole arrangement presents a compact and neat appearance. It will be noticed that the injection valve and the small globe valve supplying live steam to the condenser pump, are conveniently placed, being near together and easily reached by the engineer from the engine-room floor. The cylinder cocks of each engine are piped separately into the exhaust trunk, and the steam chest drain pipes have also independent entrance into the exhaust trunk. The condenser is shown exhausting into the trunk, and consequently a vacuum is maintained on its cylinders also.

The benefits of condensation are too well known to require any elaboration on our part. At stations where the water supply is distant, inexpensive means can often be devised whereby the water can be reached. An excellent method is to lay a conduit, connecting the water supply with a well in the vicinity of the engines. From this well the water is readily taken by the condenser if the lift is under 20 feet. Where the lift is greater, it is practical to lower the condenser by placing it in a pit. A cheap and serviceable conduit can be constructed of sewer pipe laid level, and at such a depth that a flow of water into the well is assured.

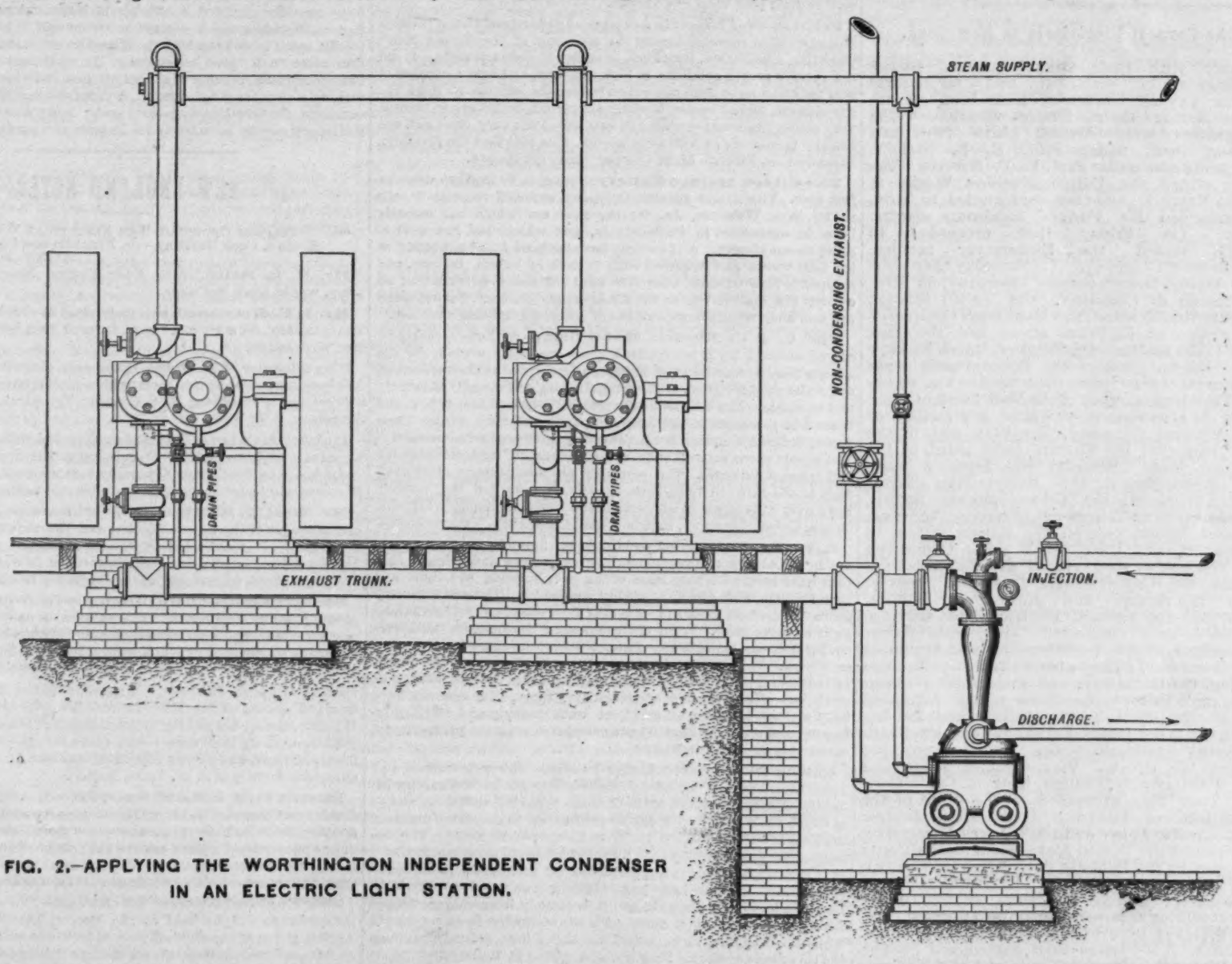
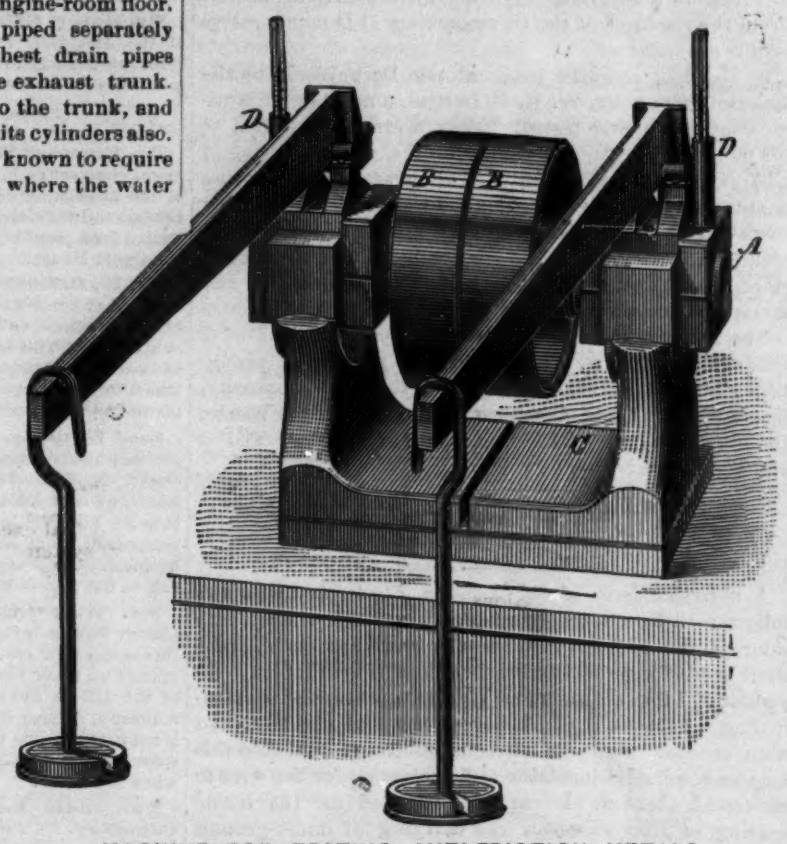


FIG. 2.—APPLYING THE WORTHINGTON INDEPENDENT CONDENSER IN AN ELECTRIC LIGHT STATION.

Post's Zero Metal for Journal Bearings.

While lubrication is an essential factor in keeping the friction of bearings down to a small percentage, experience has long since shown that the nature of the bearing surface is also an important item in the case, and thus we see a number of anti-friction metals in use, especially in journal-bearings of quick-running and heavily-loaded machinery. Recognizing the value of a good bearing metal for their dynamos and motors, the Daft Electric Light Company have recently instituted a series of tests at their works at Marion, N. J., to determine the best metal from among a number submitted. The machine employed for that purpose is shown in the accompanying engraving and was designed and patented by Mr. E. L. Post. It consists essentially of two accurately turned journals *A*, each carrying at one end a 6-inch web-pulley *B*, and united by bolts passing through the webs of these pulleys. The journals run in boxes lined with the metals to be tested. The whole arrangement is supported by a heavy, substantial base. The upper halves of the boxes can be easily removed to admit of changing of the linings, and



MACHINE FOR TESTING ANTI-FRICTION METALS.

during the progress of a test are held down by weighted levers. Each lever is of such length that a weight of one pound at its end exerts a pressure of three pounds per square inch of a projected area on the journals *A*, the latter being 1¼ inches in diameter and 3 inches long. By adding known weights to the ends of the levers any desired pressure on the bearings can be secured, so as to represent different working conditions. Each box is further provided with a thermometer well, *D*, containing oil, the temperature of which varies according to the friction of the journal in the special bearing which may be used. Motion is transmitted to the built-up pulley *B B* by means of a belt from any convenient source of power. From the readings of the thermometers *D D* comparative results are obtained.

In the test recently made at the Daft Works by the Superintendent, Mr. W. M. McDougal, a number of anti-friction metals were tested. They were each loaded to 102 pounds to the square inch, with the shaft running at 2,400 revolutions per minute. The average temperature maintained by Post's "Zero" metal was 115 degrees during a run of two hours. Of four other metals tested, two exceeded the "Zero" metal in friction by 25 and 73 per cent. respectively, and two others ran 15 minutes, then cut and stuck fast in the bearings.

The Zero metal, which is made by Messrs. E. L. Post & Co., of this city, is now employed by a number of prominent electrical concerns, including the Daft Company, Brush Electric Light Company, Edison Machine Works, Indianapolis Jenney Electric Light Company, and a number of others.

Enamel as an Insulation.

A correspondent of the London *Electrician* writes as follows: "I have recently made an invention which I consider of the greatest value to the electrical trade, and I shall be glad to publicly give them the benefit of my invention. I find that such articles as the cores of electro-magnets, bobbins, and, I believe, even wire, can be coated with enamel or similar vitreous substance, and that this acts as a splendid insulator and protection for the wire to be wound thereon. It can also be used for the inside coating of iron tubes for the carrying of under-ground wires, and I think that many of your readers will find this of the greatest value."

We may add that the idea here embodied has been suggested before.

Visit of the Cornell Electricals to New York.

In accordance with their annual custom, parties of the students in electrical and mechanical engineering at Cornell University have been on inspection trips during their Easter vacation. The electrical engineers were divided into two parties, one going west, under Prof. E. L. Nichols, and the other going east under Prof. E. P. Roberts. The eastern party visited the Edison Machine Works at Schenectady on March 21, and thence proceeded to Troy, where they inspected Mr. Powers' handsome electric light station. On Friday they proceeded to Yonkers, and visited the Eickemeyer factory, and the Otis Elevator Company. On Saturday they visited the Edison United Manufacturing Company, 65 Fifth Avenue, Bergmann & Company, the Julien Storage Station at Eighty-fourth street, the Manhattan Company's electric light station at Eightieth street and the East River Electric Light Station. On Monday, March 25, they inspected the Edison plant in the Pennsylvania depot at Jersey City, and thence proceeded to Marion, where they inspected the large factory of the Daft Electric Light Company. In the afternoon they visited the factory of the Excelsior Electric Company, Brooklyn, and in the evening they inspected the electric light plant at the Pratt Institute Trade Schools; on Tuesday they visited the Westinghouse and Sawyer-Man factories in West 23d street; the Gibson storage battery factory; the Metropolitan Telephone Exchange building, the Pearl street Edison station, the Edison station in Twenty-sixth street, and the C. & C. Motor Company's factory. On Wednesday they visited the Edison laboratory at Orange, the United States factory at Newark, the Weston laboratory, and Hewes & Phillips' engine works, and the Newark electric light stations. On Thursday they inspected the magnificent United States plant in the basement of the Equitable building, 120 Broadway. They also visited the Western Union building, 195 Broadway, the huge new Western Electric Company's factory, the offices of the *Electrical Review*, one of the Daft power stations and the big Daft locomotive, "Benjamin Franklin," on the Ninth avenue elevated railroad. On Friday morning they inspected the isolated Westinghouse plant and the offices of Westinghouse, Church, Kerr & Co. in Cortlandt street. They next proceeded to the office of the American Institute of Electrical Engineers in Temple Court, and of *Electric Power* and the *Western Electrician*. They then inspected the United States plant in the Potter building operated by the Baldwin gas engine of the Otis Elevator Co. They then visited THE ELECTRICAL WORLD offices in the Potter building, and were escorted all over the new *Times* building, where they examined the new 1,100-light United States plant driven by Straight Line engines in the basement. They were then entertained by THE ELECTRICAL WORLD at a lunch given in one of the private banqueting rooms of the Metropolitan Hotel. They then proceeded to the large Brush station in Elizabeth street, and wound up with a call at the Electric Club. The students were very keen and inquisitive throughout their trip, and made copious notes for their reports, in addition to collecting a large number of samples, pamphlets, etc. There can be no doubt as to the great good done by these annual trips.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, April 1, 1889.

The Callender Insulating & Waterproofing Company, Mr. Shaw reports, are in receipt of an order for 24,000 feet verhead wire, No. 6 B. S. for the Brush city plant at Bangor, Me.

The Schenck Beltholder.—I note that the Schenck Beltholder and Shifter Company, of which Mr. E. P. Gleason is president, have removed their offices to 189 Mercer street, the New York headquarters of the Gleason & Bailey Company, and they regard the outlook for an increasing trade as most promising.

Mr. Robert Grimshaw, president of the Polytechnic section of the American Institute, is one of the five members appointed from this country to assist at the international congress of applied mechanics at the Paris Exposition this year. The congress will consider a large number of subjects in civil, mechanical and electrical engineering.

Mr. Fremont Wilson, the consulting and contracting electrical engineer of 75 William street, has been engaged on a number of new installations and is making a specialty of isolated plants, electric railways, etc. Just now he is engaged as consulting electrician for a plant of 1,500 incandescent lights, to be put in the Harlem Opera House.

Mr. H. E. Baxter, of Brooklyn, has, I am sorry to report, been confined at home with a severe lameness which has incapacitated him for business, so that Mr. C. Baxter has a double portion of work to attend to. This is particularly unfortunate at the present time, as their spring business has opened with a big rush, and is already assuming very large proportions. They are manufacturing burglar alarms, annunciators, bells, push buttons, etc.

Lead Incasing.—Robertson & Co., 131 Water street, Brooklyn, are very busily engaged covering wires and cables with lead for the electrical market. They cover wires and cables to any thickness and length without joints for all the various electrical purposes, and they are also insulating wires and cable with a special insulating compound. They make a distinct and special matter of this line of business. They are not manufacturers of insulating wires and cables, but pay their attention solely to this incasing work.

Mr. Walter C. Wonham, Eastern manager of the Hill Clutch Works, 18 Cortlandt street, informs me that that they are furnishing their clutch couplings for the new steamboat "Puritan," of the Fall River Line. These will be used for the direct coupling of the Edison dynamos with Armington & Sims engines. This manner of driving dynamos is becoming quite popular where speed is not too high and when but few dynamos are required. It saves space and belting and in centre crank engines one balance wheel when so desired.

The India Rubber and Gutta Percha Insulating Company, 159 Front street, Mr. W. Habirshaw, manager, are very busy at present. The big steamer "Puritan" is being fitted out with their wires, and is another addition to the long list of steamers in this country that have thus been equipped. There is a large cable of this make being put in the New York conduits for one of the local electric light companies. They report a large number of orders for some of the finest new buildings in this city, as well as East and West and abroad.

Petitions for Electric Lights.—I understand that a petition was circulated recently among the members of the Young Men's Christian Association, Brooklyn, to secure the electric light. It did not receive proper attention in high quarters, and now a number of new petitions have been put out to induce the officers to light the gymnasium, locker rooms, bowling alleys, etc., which are at present very poorly illuminated with gas, and which are very close and unhealthy in summer as well as in winter. It is said that the Brooklyn Incandescent Electric Light Company may get the job.

The Gibson Storage Battery appears to be in great demand just now. The Gibson Electric Company supplied recently 92 cells to Mr. Wm. Wharton, Jr., for the new car which has recently been in operation in Philadelphia, and which has run over 50 miles on one charge. A 14 feet car has also been fitted out lately at the Daft works and equipped with 72 cells of Gibson battery, and shipped to New Orleans, where the local ordinances provide that no electric line shall be run on the direct supply system. The company are also busy with a large number of orders for lighting purposes.

The C. & C. Electric Motor Company have recently received an order for 25 reversible motors variously wound, for the Gibson Electric Company, of Europe, to be shipped to Havre, France, and to be used for general purposes, running on two cells of battery and upwards. The company have recently shipped two 2 h. p. and three 1 h. p. motors to the Edison Company, of New York. Their recent orders for motors are far ahead of their producing capacity. The season opens up well with a large demand for moters for fan and exhaust purposes. The company are now selling motors of all sizes at the rate of two or three thousand a year, and they already have over 5,000 in use in all parts of the world, including Australia, Japan, China, Germany, Russia, Cuba, Chili, Peru, Venezuela, etc.

E. E. Garvin & Co., the well-known manufacturers and dealers in machinery, announce to their customers and friends that they have secured a long lease of the new building at Laight and Canal streets, and are now taking possession. Their new factory there will contain 45,000 square feet of floor room, and will give them light on three sides. With their increased facilities for manufacturing they can execute any orders whatever that they may be favored with. Their plant will be modern in every sense of the word, including all the necessary tools for proper and thorough finish of work, as well as a number of special appliances. The concern have built up their business by excellent workmanship and sterling integrity, and are to be heartily congratulated upon the prosperity of which this step is an indication.

Edison Plants.—The Loring building, Thirty-first street and Broadway, has been wired by Messrs. Benton & McLean for 750 lights. A special feature of the dynamo room is a switch by means of which the whole system can be thrown on to the street mains of the Edison central station in West Twenty-sixth street. The isolated plant put in consists of a 600-light Edison machine run by a 11 × 16 Straight Line engine, and fitted up with all the latest appliances. Mr. Benton has put in the dynamo sold to Mr. T. C. Eastman for his big abattoir, and it is already in operation. Benton & McLean have also just closed with the Methodist Book concern to wire for 2,100 lights, to be run from the Edison central station on the three-wire system. They are now wiring P. T. Barnum's house at Bridgeport, Conn., for an isolated Edison plant of 115 lights, and the fixtures are said to be the finest in that part of the country.

The Hazelton Boiler Company, 716 East Thirteenth street, have just issued a new pamphlet on their upright boiler. It has an interesting illustrated description of the boiler and its many advantages, and includes a list of the leading concerns that have put the boiler in. Among the users of the boiler I notice the Schuyler Electric Company, of Newark, the Meriden, Ct., Electric Light Company, the St. Paul, Minn., Gaslight Company, the United Electric Light Company, of Springfield, Mass., the Spanish-American Light and Power Company, of Havana, Cuba, and the New Britain, Ct., Schuyler Company. In fact there seems to be a great partiality on the part of electric light companies for this form of boiler, and I expect to see a great many put in during the next year. The economy of boiler space is remarkable, and the abundance of dry steam, coupled with great economy of fuel, especially recommends it to plants which must be run on scientific principles to make a dividend.

Electric Meters.—I hear a good deal of talk about meters, but so far few, if any, seem to have met all the requirements and necessities of the case. Some are too delicate and some are too costly; some will only do this and others will only do that; some are controlled by this concern, and only others have a chance somewhere else. A gentleman who has had much experience in electrical instruments and in the introduction of the electric light tells me that he knows he is getting the correct thing in a new and practical meter which will give a perfect record of the current used, the reading being made directly from the entire current. It is simple and cheap and very compact, and if it be what is claimed for it, it will certainly be a good investment and open up a lucrative business.

The Amphion Theatre, Brooklyn.—Visiting this theatre, last week, to see Booth and Barrett in "The Merchant of Venice," I was very much pleased to see the beautiful effect obtained by the interior illumination, the contract for which was secured by the popular agent of the Edison Company, Mr. F. R. Chinnock. This plant was installed by Mr. C. J. Field, now the engineer of the Edison Company in Brooklyn. The theatre is undoubtedly the best lighted in this vicinity. The electric lights can be regulated and can be turned down so that the filament burns a cherry red. While at the theatre, I had the pleasure of meeting Mr. E. T. Copeland, of the New York Safety Steam Power Company, whose opinion as a critic was very favorable to the plant and the distribution of the lights.

The John Stephenson Company, Limited, have received an order for 30 electric cars for the Julien storage-battery system, to be used on the Fourth and Madison avenue line in this city. The cars are to have 16-foot bodies, mounted on independent rigid trucks, with two motors directly geared to the axles. They are to have the Stephenson truck with latest improvements, including wheel and track brakes, capable of stopping the car almost instantly. All working machinery is to be detached from the car body, which will have glass windows of extreme height, cushioned with rubber in a sash frame of bronze metal, affording a quietness and comfort not before had. Health is regarded by the ventilating ceiling, which changes the atmosphere and keeps the car comparatively cool in summer. This system of ventilation has been recommended by special action of the Board of Health of Philadelphia. In fact, every valuable appliance will be incorporated in the construction and fitting up of these cars, which, fully equipped with motors and batteries, will weigh about six tons each.

Progress in the Sprague Motor Business.—I am informed that the factory of Sprague Electric Railway and Motor Company is overcrowded with orders for motors both for stationary and railway work. The large number of railroads which have ordered the new 30 horse-power motor car equipment and improved Sprague motors would have been sufficient alone to have kept the business of the Sprague Company devoted exclusively to that branch of the electric power field. But the attention of the Sprague Company has not been devoted entirely to this class of work. They have recently received a number of large orders for stationary motors, including one to operate an entire mill in Nebraska by electricity, using more than 100 h. p. of motors, with the generating station more than three miles away. In addition to this order they have received a number of others for less individual capacity, but making a very large aggregate. Several other mills have ordered complete electrical equipments, and a large number of orders for stationary motors have been sent in from all directions. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, March 30, 1889.

Mr. M. E. Baird, of the Eddy Electric Manufacturing Company, was in town last week.

Mr. J. E. McConnell, superintendent of the H. B. Cox Electric Company, New Haven, Conn., favored this office with a visit last Wednesday.

Electrics for Whitman, Mass.—An electric light company has been organized at this town with a capital stock of $20,000. The officers are: President, D. A. Gurney; Treasurer, H. Davis, and Secretary, C. D. Nash.

Holtzer & Cabot.—This Boston electrical firm has just closed a contract with the Suffolk County authorities for wiring the new court-house on Pemberton Square for incandescent electric lighting. Fixtures will be put in for 1,000 incandescent lights.

Mr. Wm. M. Brock, formerly of Lawrence, Mass., now general manager of the Edison Electric and Illuminating Company at Paterson, N. J., spent a few days in Boston last week *en route* for his new field of labor. Mr. L. E. Barnes, of Methuen, Mass., succeeds Mr. Brock as manager of the Lawrence Edison station.

Electric Lights at Burlington.—The Westinghouse alternating plant at Burlington, Vt., has been in operation during the past six weeks and is giving satisfaction. This plant was installed under the supervision of Mr. Norman Marshall, the New England agent of the Marr Construction Company, of Pittsburgh, Pa.

Eddy Electric Motors.—Messrs. Spaulding & Buck, the New England agents of the Eddy Electric Manufacturing Company, of Windsor, Conn., are placing a good many of these motors in this section. Among their recent sales was a 10 h. p. motor for White & Brown, Boston, and a No. 3 depositing machine at the soda fountain apparatus factory of J. W. Tufts, Boston.

Electric Switches and Cut-Outs.—Messrs. Pettingell, Andrews and Company, Boston, Mass., report sales of the Haynes' double-pole switch, Royal 5-ampère switch and the K. and W. Cut-out as phenomenal. They say that the demand for these devices in New England alone is enormous. Mr. Levi Cofren, the energetic traveling representative of this firm, is having successful trips.

New England Electric Exchange.—The annual meeting of the exchange will be held at the Boston Electric Club Monday, April 8, at 2 P. M., to elect officers, etc. There will be a discussion on "Insurance requirements for electric lighting stations," and Mr. J. Perry, of Providence, will read a paper on "Economical Steam Plants for Electric Lighting Stations."

Alternating Plant at Skowhegan.—The Westinghouse Electric Company installed a plant at Skowhegan, Maine, recently, and are furnishing about 1,500 incandescent (alternating) lights; 500 of which are supplied to the people of Norridgewock, Me., six miles distant from the station. The plant is operated by water-power. The Marr Construction Company, through its N. E. Agent

Mr. Marshall, put in the equipment and did the wiring and construction work.

Harvard Electric Club.—A number of the young collegians at Harvard have organized an Electric Club. There are about twenty members to the club at present, all of whom are enthusiastic over the new departure and predict great things and beneficial results to spring from this commendable enterprise. The officers are as follows: J. Hale, Jr., L. S. S., president; F. S. Duncan, '90, vice-president; L. K. Perot, L. S. S., secretary; A. N. Barron, '91, treasurer; G. T. Page, '92, librarian. The above named with Messrs. G. T. Curtis and C. H. Chittenden constitute the executive committee.

W. I. B.

HARTFORD, Conn., March 29, 1889.

The Perkins Electric Lamp Company.—This company was organized March 15, 1889, for the purpose of manufacturing goods under Mr. C. G. Perkins' patents, especially his lamp, which is too well-known in the market to need comment. Mr. Chapman, the President, is the Vice-President of the Mather Company, and a gentleman well known in Hartford business circles and a man of rare business qualifications. Mr. Halm, V. P., is a capitalist from Chicago, who intends making the electrical field his place for future operations. He is also to be the Western business manager. Mr. Welles, treas., is the cashier of the City Bank of Hartford, and a man well known here. Mr. Gates, the secretary and business manager of the company, has been for the past four years with the Mather Company, the last two as their purchasing agent. The new company propose to go into the market with the Perkins lamp, and are ready to furnish same to go with any system. The company have purchased from the Mather Company their appliances and apparatus for the manufacture of incandescent lamps and sockets. They have also rented a part of their plant at Manchester, Conn., and have opened an office in Hartford.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., April 1, 1889.

The Chester Foundry and Machine Company are negotiating with a Chicago firm for the establishment of an agency in that city for the sale of the Brotherhood engine.

Walter George Smith, Esq., of No. 524 Walnut street, has been appointed auditor in the Partz Battery Company collapse, and is authorized to collect all debts and make all settlements.

Mr. Gardiner C. Sims, of Providence, R. I., who has been spending the last fortnight in this city, supervising the erection of his engines in the new central station of the Edison Company, leaves for New York this week.

Wetherly, Pa., has contracted for a 50 arc light Thomson-Houston dynamo, and H. M. Sciple & Co. have just sold the local company an 80 h. p. Ball engine. An incandescent plant is to be purchased, but nothing has been definitely agreed upon yet.

Motors for Monster Fans.—The selection of the motors to drive the ventilating fans in the big Drexel building was made last week. The contract calls for three 3 h. p., one 7½ h. p. and one 2 h. p. motor, which will all be furnished by the Sprague people.

W. A. Stadelman, of the firm of Chadbourne, Hazleton & Co., is arranging to place a small motor on a tandem tricycle, for coming summer excursions. Current will be taken from a small battery attached to the axles. It will be something of a novelty when completed.

J. W. Parker, of H. M. Sciple & Co., has lately concluded arrangements with the Pottstown Electric Light Company for the delivery of a 150 h. p. engine. A 30 h. p. Ball engine was recently sold to James Wilde, Jr., for driving a 25-light Thomson-Houston machine.

Mr. V. J. Mayo, inventor of the Mayo dynamo made by Clark Bros., of Belmont, N. Y., met with quite a painful accident the other day. He lifted several heavy armatures and seriously strained the muscles of his back. He is improving under careful treatment.

The Pottstown Electric Light Company have just purchased an additional 500-light shunt machine from the United States Electric Lighting Company, increasing their plant to 1,000 lights. The company also have 50 arcs in the town, and intend doubling that number before June.

Edison Inspectors.—Messrs. Walter Wright and William Henry Weston have been appointed inspectors by the Edison Electric Light Company of this city. Both are well known in electrical circles, Mr. Weston having been a pupil of Prof. William A. Anthony, late of Cornell but now of the Mather Electric Company.

Mr. P. F. Kelly has tendered his resignation as treasurer of the Edison Electric Light Company, of this city. Mr. Kelly is a member of the firm of B. K. Jamison & Co., and finds his combined responsibilities too onerous. It is supposed that the company will combine the offices of secretary and treasurer under the title of secretary-treasurer.

Benson & Thompson the well-known manufacturers of insulated wires, are very busy filling orders for annunciator wire, office and magnet wire and flexible cordage. They report an exceedingly heavy trade in these specialties. This enterprising firm are constantly making improvements in their machines, and are now turning out some of the best made goods on the market.

Mr. H. G. Bryant, who has been connected with the Edison Electric Company, of this city, as secretary, since its incorporation, has announced his determination of resigning the office. Mr. Bryant is a lawyer, and intends practising his profession in this city. Those who have had dealings with the Edison Company remember Mr. Bryant's courtly manner, and join his associates in regretting his resignation. Who will succeed him has not yet been determined.

Partrick & Carter, the well-known dealers in electrical supplies, will shortly issue a new catalogue of their specialties and regular goods. It will be most complete, and instead of dividing the line of goods between two catalogues as heretofore the lists will be combined in one volume. Among the new things being put on the market by this firm is an upright annunciator in the regular sizes up to 12 needles. They are also making a four-case bell box for economy in space and cost.

Mr. James Brannen, treasurer of the firm of Horn, Brannen & Forsyth, is something of a wag. A caller stepped into his office the other day and greeted him with: "How's business? Mr. Brannen." "Pretty fair," was the response. "We are just considering a proposal from Secretary Blaine to put electroliers in the palace of King Molasses, of the Samoan Islands." "What for?" was the innocent query. "To throw light on the Samoan question, I presume," answered Mr. Brannen, gravely.

Professor Marks' Address.—Prof. William D. Marks, supervising engineer of the Edison Electric Lighting Company of this city, gave an illustrated lecture on electricity and some of its uses before the Young Men's Christian Association, in Association Hall, last Thursday night. The large audience filled the lecture room completely and gave a deep attention that was complimentary to the speaker. Professor Marks gave some practical illustrations of motor work, using the Sprague and "C. & C." motors for driving a printing press, fans, machines, etc. He also described the new Edison central station at length, saying that the capacity would shortly reach 10,000 h. p.

Car Building.—Making cars for electric street railways has become a feature with the J. G. Brill Company, of this city. Some of the contracts just completed are: One storage battery car for the Gibson Storage Battery Company, for New Orleans; six handsome cars for Nashville, Tenn., Thomson-Houston system; several trains, consisting of motor car and double-decked drag car, for the Washington street railway. The firm has just completed six pairs of trucks for the Pennsylvania Railroad Company, for their Atlantic City road, which were shipped last Wednesday, also four cars complete for the Chattanooga Electric Railway Company, and two cars complete for Tacoma, Wash. Ter.

Enjoining a Railroad Company.—Work on the electric street railway that the Pennsylvania Railroad Company is constructing on Atlantic avenue, Atlantic City, N. J., was stopped by legal authority last week, but only temporarily. It appears that there was a misunderstanding over the provisions of the franchise granting the railroad company the privilege, and in order to settle that several citizens had an injunction issued by the Supreme Court at Trenton to compel the cessation of work. The claim was that the company should agree to light the avenue on which its road runs without cost to the city, which was denied by the company. On Tuesday last the company succeeded in having the injunction dissolved. Work was immediately begun again, and will be pushed to a speedy conclusion. About one mile of poles is planted, and on Wednesday last the truck for carrying the motors was received at the station. It will be a model road in every respect when completed.

Curiosity About One of Edison's Inventions.—About a fortnight ago the New Jersey and Pennsylvania Concentrating Company, in which Thomas A. Edison is supposed to be interested, bought a tract of eight acres of iron ore lands near Bechtelsville, Berks County. O. S. Hussey, the superintendent of the company, erected a shed on the ground and stored within it all the plans for the additional buildings which are soon to be constructed. It is said to be the intention of the company upon the completion of its plant to experiment with a new electrical process for reducing ore. All the agents of the company have been very guarded about their statements, and such a strict watch was placed upon the premises that a deep veil of mystery has surrounded the entire proceedings. The strain proved to be too great for the residents of Berks County, and when the superintendent visited the shed the other day he found that some one had broken into it and abstracted all the diagrams relating to the buildings. The thief evidently thought he was getting the key to one of Edison's most valuable discoveries.

The Electric Car Company of America, of which Mr. W. Wharton, Jr., is president, has just concluded a series of experiments with their storage battery car with very satisfactory results. The car that was tested was fitted with motors constructed by Mr. George H. Condict. The current was furnished by 72 cells of the new Gibson type, made by the Gibson Storage Battery Company, of New York. After a thorough trial in the shopyard upon a circular track 1,000 feet in circumference, the car was run upon the tracks of the Lombard and South street line, and given a ten-mile trip. Never once during the whole run did the motor or batteries fail to respond promptly to the demands made upon them. A speed of eight miles an hour was easily maintained, and when a clear track was reached the wheels revolved at a ten-mile gait. The officers of the company were much pleased at the showing of the car, and Mr. Condict declares he is ready to fit out any road with the company's system and assure its success. Preparations are being made to ship an additional car to New Orleans, and the Sacramento Street Railway Company are so pleased with the success of the electric company's car on the Pacific coast that they are importunate in their demands for "more cars."

E. F. C.

PHILADELPHIA, March 25, 1889.

A Gratifying Increase in Membership.—The officers of the Franklin Institute are highly pleased at the rapid increase of membership within the past few months. Since Oct. 1, 1888, 404 new names have been added to the Institute rolls, which now number 2,304.

The American Telegraph and Telephone Company was granted the privilege by City Councils last week of erecting wires and poles on Lansdowne avenue, west of Fifty-second street, and on Pennock street, in the Twenty-fourth ward. An ordinance was also adopted providing for the erection of electric lights throughout the city.

Charters Granted.—Among the charters granted at the State Department last week was one for the People's Light and Power Company, of Pittsburgh, capital $10,000. A charter was also granted the Indiana Telephone Company, the line of which will be extended through Indiana, Cambria, Clearfield and Jefferson counties. The central office will be at Indiana, and the capital is $10,000.

The Keystone Light and Power Company has decided to appeal to the Supreme Court the injunction case which was decided against it by Judge Allison on Saturday, the 16th inst. The company holds that by its State charter it has the right to lay conduits in this city. The city having refused to allow it to extend the territory through which its pipes run, an injunction is desired to shackle the city officials.

A New Electric Railway in Wilmington.—The stockholders of the Wilmington City Passenger Railway Company met last Friday and decided to build a new electric road on Eighth street. It is supposed the road will be completed about July 1, of the present year, and the estimated cost is $40,000. Work will be begun as quickly as possible. It is probable that the Sprague system will be used, as that has been successful on the Market street extension. The subject of a road on this street has been agitated for some time—the growth of the city in that direction having warranted the venture.

Sheriff Sale of Electrical Goods.—The effects of the Partz Battery Company were disposed of at Sheriff's sale on Monday last. The list embraced all the well-known Partz appliances, together with a number of La Roche motors, and supplies of every description. Some of the goods brought fair prices, but at times the bidding was not spirited, hard wood push-buttons, for example, selling for four and five cents apiece. An auditor will be appointed by the court to wind up the affairs of the company, and the creditors' claims will be settled pro rata. It will probably be six months before a final adjustment is made.

The National Electric Light and Power Company has just completed the erection of an incandescent plant in the Ivy paper mills, at Swarthmore, owned by J. Howard Lewis. Most of the government bank-note paper is made at this factory. The dynamo is a 50-light Cohen machine. The building is wired for forty lamps, the additional ten being reserved for any additions that may be made in the building. The machine was first started last Wednesday night and was a complete success. Mr. Lewis had a number of friends at the trial and most of the officers of the National Company were also present.

Inspecting the City's Electrical System.—Alderman Tate and City Engineer Charles Sprote, of Toronto, Canada, were in Philadelphia on Thursday making a general inspection of the city underground electric system, the street electric lights, the police patrol, etc. They were supplied with data by Chief Walker, of the Electrical Bureau. Alderman Shaw and other officials of Toronto were in Philadelphia on a similar errand on Wednesday of the previous week. Officials of Bridgeport, Conn., also consulted Chief Walker on the same day and were shown the operations of the police and fire-alarm signal and telephone service, and electrical affairs under the control of the city.

Exhibition of Primary Battery Work.—The Self-Storage Electric Company gave an exhibition of the working of their battery last Saturday, at their offices, No. 733 Sansom street. With the cells arranged in series, a maximum current of forty ampères was obtained, and the potential reached 85 volts. Some of the illustrations were: Lighting a Simplex arc lamp of 10 ampères and 50 volts from twelve sets; running a 2½ h. p. motor from fifteen cells and a one-half h. p. motor off four cells; lighting a series of nine 16 c. p. incandescent lamps (5 watts) from 15 cells, and running a sewing machine attached to a one-eighth h. p. C. & C. motor with one cell. These cells are of a large type, and were invented by Mr. J. H. Jenkins. His process of making the electrolyte is the secret of his invention, although his arrangement of the elements is somewhat new. The stockholders and visitors who were present were greatly pleased with the exhibition, and congratulated Mr. Jenkins upon his success. The company was recently incorporated under the laws of New Jersey, and at a regular meeting elected these officers: President, Charles L. Apple; secretary, C. L. Chapman; treasurer and general manager, J. H. Jenkins. Some of the leading stockholders are: E. Cooper Shapley, the well-known attorney; A. J. Michener, B. F. Allen, J. B. Wickersham, W. P. Ward and D. T. Davis. Their manufactory is at No. 1,614 Columbia avenue.

E. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, March 30, 1889.

Mr. F. W. Horne, the energetic manager of the Excelsior Electric Manufacturing Company, has been making a business trip through the Southwest.

The Electrical Construction Company report an increase of business, having received some very large orders the past week. They are also making some very handsome instruments.

Removal.—Mr. C. F. Dunderdale, who is in the employ of the Westinghouse people, has moved from his old office at 154 La Salle street to the offices of the company at the corner of La Salle and Adams.

A St. Joseph Lighting Contract.—The contract for lighting the city of St. Joseph, Mo., has been awarded to the Sperry Electric Light Company, of Chicago. The contract calls for 210 arc lights, and will entail 30 miles of wiring.

The Charles Munson Belting Company of Chicago has sold through Mr. J. H. Shay, to the Minnesota Brush Electric Light Company of Minneapolis, a belt 68 inches wide and 140 feet long. It is said to be the biggest belt in the country.

Mr. F. N. Armour, who has been the Western agent of the C. & C. people, has left that position to sign with the Belding Electric Motor Company, of Chicago. Mr. Lewis, formerly with the Sprague people, is to take the place left vacant.

A Dynamo of Special Design.—Simonds Bros., of Detroit, have ordered from Mr. Foree Bain a ten-horse power dynamo of special design. The dynamo is to be used exclusively for charging storage batteries which are used in lighting their factory and store.

The Chicago Electric Club.—At the last meeting of the Chicago Electric Club a practical talk upon wiring was given by Mr. George Cutter, the well-known electrician of the Thomson-Houston Electric Company. The talk was thoroughly interesting and was ably illustrated.

Local Business.—The business of local electricians this year is much better than usual, owing to the open winter. Mr. Charles D. Welch is wiring seven houses out at South Park avenue, and two on the Grand Boulevard. One of these is to be fitted with electric lights, bells and tubes complete.

Installations of the Sperry System.—The Sperry Electric Company have sold a six arc light plant complete for the steamer "William D. Ellis," Columbus, Ga.; a six arc light plant to the Chicago, Wilmington & Vermillion Coal Company, to be used in their mine at Braidwood, Ill.; a two arc light plant complete to local parties for shipment to Elmira, N. Y.

A New Electrotyping Dynamo.—Improvements are being made on the new electrotyping dynamo made by Mr. Foree Bain for the American Electrotyping Company, of this city. This dynamo is a four volt machine, with a capacity of 2,000 ampères. The new machine is now under construction, and will be completed soon. Mr. Bain intends to put these machines on the market.

Another Electric Coal Digger.—Readers of THE ELECTRICAL WORLD will remember that in a recent issue there appeared an illustrated article upon the Sperry Electric Coal Digger. Now the proprietors of the Legg coal digger are getting out a motor to be attached to their machine in place of the compressed air device formerly employed. The motor is in process of construction.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 LaSalle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150@$153	Iowa Union	22@ 25
Central Union	50@ 51	Michigan	81@ 82
Chicago	300@ 305	Missouri and Kansas	60@ 70
Colorado	39@ 40	Rocky Mountain Bell	40@ 41
Cumberland	67@ 69	Wisconsin	116@ 117
Great Southern	31@ 33		

Mr. C. A. Coffin, representing the Thomson-Houston Electric Light Company, has, it is stated, finally effected an agreement for the purchase of the stock of the Fort Wayne Jenney Company. The price paid is said to be $380,000, divided between Messrs. R. T. McDonald, John H. Bass, H. G. Olds, P. A. Randall and M. W. Simons, trustee of the estate of O. A. Simons, deceased. Each of the above retain a single share of the stock, and Mr. McDonald continues as general manager.

Another Motive Power for Dynamos.—Steam and water power have now become recognized agents for supplying motive power for dynamos. Until recently the perfection of the storage battery system has not been advanced so that the use of wind was practicable. It is now, however, being largely experimented on. A private residence in Omaha, Neb., is to be entirely lighted by storage batteries. These are to be charged by a small dynamo,

which is geared to a windmill. Whenever the wind is blowing, the dynamo is set to work, and about the same amount of E. M. F. is kept all the time in the batteries.

Novel Applications of Electricity.—Incandescent lighting here in Chicago is being made as artistic as possible. In the Sherman House the small bulbs are surmounted by a large reflector which radiates the light. It is in the Grand Opera-House that the most novel system is introduced. In front of the top of the proscenium arch a sort of ornamental sounding board is studded with incandescent lamps. These are thrown in circuit simultaneously and light up the whole theatre.

An Electric Tricycle.—Although the occasions are few when America takes a second-hand idea, the electric tricycle is one. The readers of THE ELECTRICAL WORLD will doubtless remember the electric dog-cart of the Sultan of Turkey. On the same principle Mr. Foree Bain is experimenting with a small set of storage batteries to operate a motor on his tricycle. He will use seven cells of the Pumpelly system. The motor he is building himself is of a peculiar pattern, adapted to the needs of the particular service to which it will be put. This machine is not intended for commercial use, but for Mr. Bain. It will be charged at his factory every morning, and this, according to his calculations, will be sufficient to carry him from his residence to the workshop and back, a distance of seven miles. To provide for any accident, however, he is to have a pair of treadles with him.

Vulcabeston.—Western dynamo builders and electricians are taking up the new patent "Vulcabeston" with much more readiness than was anticipated by the agents, the Johns Manufacturing Company. This substance, of which asbestos is a principal ingredient, can be used with material benefit by the electrical manufacturing companies. The Eddy motor people are using it to make a sleeve for their armatures. All such appliances as lamp holders, dynamo bearings and the like can be made from it. A feature that is going to be developed is its applicability to storage battery uses. The cells, made from it are, it is claimed, lighter than those of any other material extant. This is a great point, as one of the aims in street-car work is to decrease the weight of the storage batteries. Despite a little greater cost, it is already in favor with those interested. The reason of its greater cost is that the materials of which it is composed are so difficult to press into shape, unlike rubber, which requires but comparatively light pressure to take the required shape. It requires to be worked in three different sets of molds. The first pressure leaves it in a spongy condition. The second pressure hardens it, but it is still too spongy to be of any use for a cell. The third pressure is the most powerful, the die and mold being made of a metal specially prepared upon the other side of the water. This leaves a hard, dry substance, which has been given the name "Vulcabeston." The cell is then trimmed down, and is ready for the market, being about the hardest substance of the kind I ever saw.

Another Niagara Scheme.—Just now the schemes for utilizing the great power of Niagara are almost numberless. The following, clipped from the *Tribune* of recent date, may be found of interest to your readers: It is a law of hydraulics that the power at the bottom of a column of falling water may be obtained at the top as well, provided the column falls through an air-tight shaft or pipe. The suction is equal to the momentum. A turbine wheel, in other words, receiving the inflow into a suction pipe, will run as much machinery as one receiving the outflow.

By utilizing this law Mr. Christian J. Zeitinger, mechanical engineer, proposes to get rid of the inconveniences of placing and operating a power plant under Niagara Falls. His scheme is to locate a plant in the river above the precipice.

Mr. Zeitinger will undertake to swing by means of cable a coffer into the American channel about 150 feet from the edge of the falls, where the depth is from 10 to 12 feet. The coffer is to be 120 feet long by 35 wide and 25 or more in height. It will be constructed of three steel walls, the outer two supporting each other as a breakwater, and the space within the inner housing eventually the machinery and operatives. Its upstream end will be pointed like the prow of a boat. Sunk to the bed of the stream, the bottom of the coffer will be removed and the space between the inner and next walls filled with concrete, which, with steel-plate supports, will be extended into the irregularities of the bed-rock so as to make an effective dam against the outside water. The water in the interior will then be pumped out. By building in a bulkhead of masonry, set in a suitable excavation, the coffer will be permanently anchored to the bed-rock.

From the stern of the dry interior a shaft 18 feet in diameter will be sunk vertically downward through the 90 feet of limestone. The shaft will then be run horizontally down stream until it opens on the face of the precipice. A suction pipe put through the shaft, inlet openings connecting with the pipe made in each side of the stern of the coffer, turbine wheels placed between the two openings and the head of the pipe, and the plant will be ready to convert the power of Niagara to use. Dynamos of from 350 to 500 horse-power, located in upper stories of the coffer, will receive the power from the turbines. An underground tunnel leading from the shaft will conduct it ashore. By duplication of the coffers a practically unlimited power may be obtained.

Theatre Lighting at La Crosse, Wis.—The La Crosse *Chronicle* has the following account of an interesting installation in the local theatre: No doubt most of last night's audience realized the important contribution to the general harmonious effect, of the electric lights; yet few we suppose gave much thought to the wonderful, delicate, yet simple mechanism by which the system is manipulated. There are in the building 435 sixteen candle power lamps, all except half a dozen or so, controlled at the switch-board just beyond the encore door on the left of the stage. In the ceiling and sounding board (that is, the part of the ceiling which slopes down to the proscenium) there are 128 lights; in the foot-lights 28; in each of the four borders 30; below the balcony rail 32; beneath the balcony 32; then there are the wing lights, brackets, entrance, dressing rooms, basement, etc., to make up the number above named. The "borders," it should be explained, are the overhead lights back of the stage, set in a reflector and throwing a flood of light upon such portions of the stage as may be desired. Each of the four borders turns on with a separate switch and then is controlled by the graduating device, so that from the full power down to a faint glow twenty-five different degrees of light may be obtained. The ceiling is controlled in the same manner, and also the footlights. It was in the ceiling that the audience noticed it chiefly. A lever moves upon the segment of a circle with twenty-five gradations, each one representing an increased or diminished degree of light. The method of control is resistance, and this means in electricity just what it means in any other connection. In the basement there is an iron frame four or five feet high composed of two square plates with stout rods at the corners. Between these plates are twenty-five coils of iron wire made like an ordinary coil spring. Three elements enter into the resistance: Length, thickness and material of the wire. It is all iron and of several sizes. By moving the lever on the switch-board one notch, the current that goes to the ceiling, foot-lights or borders is all passed through one of these coils which diminishes the intensity one twenty-fifth; a second notch passes it through two coils, reducing it two twenty-fifths, and so on until the carbons only faintly glow. The borders and foot-lights are all fitted for using the same number of red or other colored lights as of white, but as there were no lurid passages in the opera they were not used last night.

The wires approach the building from three directions, and different sections of the house are on different feeders; so that three accidents to outside wires would be necessary before the building would be left in darkness. Besides all this, the stage is fully piped for gas, which may be turned on at a moment's notice. The bracket lights in the auditorium are also fitted for gas, so that in event of machinery at the electric works being stopped by any accident the theatre would still be lighted sufficiently to do business.

By a simple device, not necessary to describe, the lights are so arranged that any accident to any wire running through the building would only put out two lights instead of the whole series on that wire. At the point where the wires enter the house there is an arrangement by which any excess of current will fuse a piece of lead and cut it off before the danger point is reached. At this point also, the current is all turned off when the house is not in use. In all the nooks and corners lamps are placed which make it wholly unnecessary ever to use lanterns, candles or any such lights.

One other of a number of interesting matters we mention because it is suggested by an overheard query: "How do they get at those ceiling lights if one gets out of order?" There is a vast attic above the ceiling roughly floored and electric lighted. Above every ceiling light there is a moveable board in the floor which discloses the lamp fastened to a wooden block and fitting nicely into a round hole. It may be drawn out, changed or otherwise attended to and slipped back without attracting notice during a performance. Mr. Cobb, the architect, says there is not a better electric plant in any theatre in America and the work has been done by the La Crosse Edison Light and Power Company in an absolutely perfect manner.

W. A. N.

CHICAGO, March 23, 1889.

An Electrically Lighted Capitol.—A contract for $10,000 for furnishing the electroliers for lighting the capitol building at Atlanta, Ga., was awarded recently to T. H. Wilmarth of Chicago. The same firm has taken the contract to furnish the new building of the New York Life Insurance Building at Kansas City, Mo., with a combination gas and electric lighting fixture. This contract is for $5,000. A large show room is being fitted up for the firm at their place of business, at 225 State street. This room is about twenty by thirty feet. It is handsomely carpeted, and the various styles of electroliers and combination fixtures are arranged in a very artistic style.

A Motor Trial Trip.—The Patton Car Motor people gave a public exhibition of their motor at the Pullman Works last Saturday. As has been previously stated in these columns, the engine is a gas engine and drives a fly wheel in the middle of the car. The distinguishing feature is the friction arrangement of gearing. There are two complete sets of gears, one for a forward and one for a backward motion. The engine is not reversed nor stopped during the entire run of the car.

Underneath the floor of the car is suspended a rectangular iron frame. This is the agent by which the gearings are regulated. It is controlled by a lever, and can be thrown forward or backward by which the contact with either axle is made. Already a number of contracts have been placed for western towns. Their new modeled car of the storage battery order is progressing and soon will be ready for its initial trip.

Installations of the Thomson-Houston System in the West.—An addition has been made to the plant of the Citizens Electric Light Company of Wichita, Kan., by the installation of a 600 light alternating machine. This is the third in the last year. A. L. Ide of Springfield, Ill., has bought a 100 light arc plant. The Winchester Electric Light Company of Winchester, Ind., has ordered a 50 light arc plant. The city of Rochester, Ind., has contracted for an arc plant of 50 lights. An incandescent plant of 200 lights capacity has been sold to Franklin McVeagh & Co. of this city. There has been sold to a new electric light company at Beardstown, Ill., a plant of 100 arc lights. A plant was this week shipped to San Francisco consisting of 50 arc lights. There has been sold to Falkenberg & Foster of Chicago for the central station at 31st street a 60 light arc plant. A small plant has been shipped to Dakota. This plant consisted of 30 arc lights and went to Madison. The El Paso Electric Light Company of Colorado Springs, Col., have increased their plant by the addition of a 50 light machine.

W. A. N.

KANSAS CITY, Mo., March 27, 1889.

Mr. E. B. Kay, engineer for the Excelsior Springs Hotel Co., will shortly request bids for two new machines of 400 lights each. This will complete the illumination of the Hotel, Bath House and Opera House as originally projected, the capacity being nearly doubled by the new machines.

Joplin, Mo.—A special dispatch from Joplin of March 5, says: The plant of the Joplin Electric Light Company, O. R. Moffet, principal stockholder and general manager, located at Shoal Creek Falls, four miles south, was burned last night. The building caught fire in the roof, origin unknown. The actual loss is not known, as it is not certain to what extent the dynamos are damaged. The cost of the building, machinery and fixtures was $10,000, in sured for $2,000.

Missouri & Kansas.—The stockholders of the Missouri & Kansas Telephone Company met recently and elected A. O. Morgan, of Boston, in the place of George L. Phillips, of Chicago, deceased. The directors met, too, and accepted the resignation of C. D. Crandall, who has filled the dual office of secretary and treasurer and who now goes to Chicago to accept an important position with the Western Electric Company. In his stead are W. W. Smith, Secretary, and N. R. Ferguson, Treasurer, both having been long in the employ of the company at Kansas City.

The Thomson-Houston Company have signed contracts for equipping the Armourdale Horse Railway and the Vine Street Motor Railway with power plants and motors, but have as yet made no constructive move. The former line is about three miles long and almost level; it has been in operation for some years, and the financial features involved are easily determined. The latter road is two miles long with grades of 3½ per cent.; it only began operation last fall, and although doing as well as anticipated, is not yet paying any fixed charges.

Kansas City Exposition Building.—A local Kansas City paper says: The big exposition building is in darkness. There has been trouble for a week or so over the electric light engine, for which the Phœnix Iron Works of Meadville, Pa., has never been paid. It was attached and the Exposition Company failed to give a $2,000 bond. After waiting the required time Sheriff Sitlington had an engineer take the engine to pieces and yesterday it was shipped back to Pennsylvania. The Exposition Company had rented it to the Kansas City Electric Light Company, which used it in supplying that section of the city with electricity and now many who depended on electric light find themselves without it.

SOUTHERN NOTES.

BALTIMORE, March 25, 1889.

The Brush Electric Light Company will occupy and operate their new station of a capacity 2,500 horse-power in about two months.

The International Telegraph, District and Construction Company have increased their capacity to the extent of adding two new boilers and engines and two Heisler dynamos.

Annapolis, Md.—The electric plant at Annapolis, Md., is very nearly completed, the boilers, engines and dynamos, etc., being already on hand, and the station will be in operation by May 1.

The Westinghouse Alternating Dynamos used by the United States Electric Light Company here are reported doing good work. To show the area which may be covered by the use of the Westinghouse system I may state that they have, within the last week, filled an order for twenty-five incandescent lamps at a distance of three miles from the station.

Storage Cars for Baltimore.—The decision of Judge Coxe, in the United States Circuit Court in New York, will probably have the effect of placing very soon upon the Baltimore city tracks the electric storage car which was withdrawn last summer, pending a suit for infringement of patent. It is said that assurances have been given that the city railway companies will adopt the electric motor, as soon as they are satisfied there will be no litigation.

The Waterhouse Electric Company have recently taken up the power business and are now supplying current for four one horse-power Eddy motors; three Sprague motors, one six, one two, and one one horse-power; also to a number of Baxter motors. The business of this company has so increased as to necessitate the addition of two 100 horse-power boilers and a corresponding number of dynamos and engines. They use small direct coupled high-speed engines.

Graham Bell on Heredity.—Mr. A. G. Bell delivered a lecture here this week, at Johns Hopkins University, on "Heredity." He said that though his name was most familiar in connection with electrical subjects, he was first engaged on the subject of heredity, being, in fact, a teacher in a school of deaf and dumb mutes before ever beginning his experimental researches in the electrical field. Now he is returning to his first study, and hopes to prevent the breeding of a race of deaf and dumb mutes in the United States, the formation of which the existing condition of affairs seems to favor. That is to say, he objects to teaching them a language of their own and isolating them from all but their unfortunate fellows by sending them from early childhood to schools where none but they are admitted. To prove the fact of this tendency towards forming a race of deaf and dumb people he cited ample evidence in the form of statistics, which indicate that over 90 per cent. of the deaf and dumb mutes of to-day marry (if they marry at all) deaf and dumb mutes. The world owes an everlasting debt to Mr. Bell for his researches in *electricity*, and it may some time owe an equal debt for his work in this his present field of study—heredity.

DALLAS, Tex., March 14, 1889.

The Western Electric Co. was awarded recently the contract for the city plant at Galveston, Texas. Work will be commenced at once.

Marshall, Texas, has replaced the gas light with electrics. Forty additional lights were turned on last night, making the city as brilliant as one could desire.

Mr. H. M. Sutton, the well known electrician, has resigned from the Electric Light, Power and Manufacturing Company, and has entered the service of the Queen City Electric Light Company.

Clower & Harris report business as very good. They are enjoying an unusual demand for motors and find it difficult to fill orders as rapidly as desired. Their various lines show that their efforts to keep up to the demand is appreciated.

The Dallas Electrical Society met again last evening in regular session with a large number present. After the transaction of business the society proceeded to listen to a most admirably written paper by Mr. W. T. M. Mottram, the well-known Edison agent, entitled "The Present and Future of Electricity, and Its Applications." The paper was interlarded with Mr. Mottram's most choice anecdotes, and rendered in his characteristic happy vein of humor. He was liberally applauded at the finish as an evidence of appreciation on the part of his hearers. The society then listened to part of a paper on "Steam," by Mr. Wm. F. Lape, the chief engineer of the Electric Light, Power and Manufacturing Company. Mr. Lape is taking the members through a course of lectures on steam and its uses, and the greatest interest is evinced in the subject.

The society is meeting with continued success and new members are being added at each meeting. They recently sent out a circular letter asking co-operation in establishing a collection of books, catalogues, samples, models, &c. And the result has exceeded their fondest anticipations. All have responded liberally and the nucleus of an extensive museum has been formed; a full list of the donors will be given later on. The society appreciates the kind efforts of the various manufacturers and dealers to make the rooms interesting.

CHARLESTON, S. C., March 16, 1889.

The Charleston Light and Power Company, of this city is running up to its full capacity of 150 arc and 1200 incandescent lights, and has orders on hand that cannot be filled until additional apparatus ordered shall have been received. The company has in use 4 Thomson-Houston arc dynamos, one a 30-light, two 45-light and one 50-light. It also has two 650-light Westinghouse alternating incandescent dynamos, and a third 650-light Westinghouse machine ordered. The engine is a 250 h.p. Putnam, manufactured at Fitchburg, Mass. It runs at 75 revolutions, and, Superintendent Upson says, does good work. The company is not doing anything in the way of supplying power, but will take up this branch of the business as soon as some alternating motors, promised within a short time, are received. Major Geo. B. Edwards, a genial and pleasant Southern gentleman, and the South Carolina agent of the Thomson-Houston Company, is president of the Charleston Light and Power Company. The gallant major is well informed on Southern matters and one always enjoys a chat with him. Mr. F. P. Upson, a graduate of the Lynn factory, is the superintendent. Mr. James Chambers, who held the position of superintendent some time ago, is now the Thomson-Houston Constructing Engineer for the South, as assistant in this territory to Mr. H. D. Patterson. The Southern Bell Telephone Exchange here continues to add to its number of subscribers. Mr. John D. Easterlin is the district superintendent, and Mr. J. Edward Torbett the manager. Mr. D. O. Driscoll is still manager of the Western Union Telegraph office.

SAVANNAH, GA., March 18, 1889.

The Savannah Brush Electric Light and Power Company here does a very good volume of business, considering the size of the city. It supplies 175 Brush arc lights, and 2200 Westinghouse incandescent lights. The city takes 100 of the arc lights, the streets being lighted principally by 11 "Detroit" towers, each tower having three 2,000-c.p. lamps. When the present contract expires, it is thought that the towers will be replaced by poles through the streets on which single lamps will be placed.

The company has one No. 8 (65-light) Brush dynamo and four 650-light Westinghouse machines. Three Straight Line engines of 55 h.p. each and two Buckeye engines of 125 h.p. each are in use. The boilers are supplied by the Woodbury Engine Company, of Rochester, N. Y. Mr. S. P. Hamilton is president of the company, and Mr. T. P. Keck, superintendent.

ENGLISH NOTES.

(From our own Correspondent.)

LONDON, March 5, 1889.

Taff Vale Railway and the Electric Light.—The directors of the Taff-Vale Railway Company have decided to light two trains on the Pemarth section by electricity by way of experiment, with the intention if the system proves successful of extending it to the whole of the trains on the line. The method to be employed is substantially the same as that which works so well on the Brighton & South Coast Railway. The dynamo, which is a Brush machine specially wound so as to maintain a constant terminal E. M. F. with a variable speed, is run off the axle of the guard's van. The 12 c. p. Edison Swan lamps are run direct off the dynamo when the train is going at its normal speed, but whenever the train slows down the lamps are automatically switched on to a battery of accumulators. During the time the train is running, the dynamo is charging the accumulators as well as furnishing current to the lamps.

The Anglo-American Brush Corporation.—The Directors of the Anglo-American Brush Corporation have just issued a lengthy report upon the results of last year's trading. As this company is one of, if not the largest of the kind in this country, some details of the report may not be without interest to your readers. The improved condition of the electrical industries has shown itself very markedly by an increase of about 38 per cent. in the volume of business, as compared with the previous year. The gross profits have increased by 70 per cent., while the standing charges have only increased by some 7 per cent. An instructive diagram showing the fluctuations during the last five years in the volume of the business, the expenses of management, and the gross profits is appended to the report. From this it can be seen that the business of 1888 is to that of 1883 as 307 to 100, while the gross profits have increased over 242 per cent. and the standing charges have *fallen* to no less than 35 per cent. With these figures before them, the directors would seem to have made good their claim to energetic and economical management. Referring to the incandescent lamp litigation, which is, of course, deeply deplored, the report says: "When the Cheesborough patent was upheld by Mr. Justice Kay, in the recent action of Edison & Swan vs. Holland and others, the corporation at once devoted attention to the production of a lamp in which the Cheesborough process of flashing could be dispensed with, and their efforts were so successful that the present form of Victoria lamp ranks as one of the most efficient in the market." In spite, however, of the favorable nature of this report, it is unfortunately characterised by an omission hitherto common to most reports of electrical companies in this country, I mean the omission of a dividend; the only reference to this important subject being "that very sanguine expectations with regard to the future development of the business and payment of dividends are justified."

The Gaulard-Gibbs Action.—I have already advised you by cable that the judgment of the Court of Appeal in the case of Ferranti v. Gaulard-Gibbs had resulted in a confirmation of the decision of the court below, whereby the patent was pronounced null and void. Your readers will perhaps remember that Mr. Justice Kekewich, who tried the case in the first instance, based his decision upon a point of law, holding that the attempt to amend the patent in the year 1886 had virtually resulted in an enlargement of the claims originally filed in 1883; and that this was contrary to one of the fundamental principles of patent law. The Court of Appeal took precisely the same view. The two judgments nevertheless differ considerably as to the relative estimates which they place upon the actual value of the Gaulard-Gibbs invention. Mr. Justice Kekewich, while admitting the utility of the invention as described in the specification, cast grave doubt upon its novelty. The Court of Appeal, on the other hand, expressly stated their belief that, although several inventors had "come very near" to the idea disclosed by Gaulard & Gibbs, none of them had actually come up to it; and they were, therefore, of opinion that had the patent been properly drawn in the first case, the patentees would have been entitled to a monopoly of the whole system of transformer working. This divergence of opinion on the part of the two courts, although it has no practical effect upon the decision in the Gaulard-Gibbs case, is, nevertheless, of very considerable interest in view of recent developments. Your readers will perhaps be surprised to learn that an announcement has just been made to the effect that all the leading makers of transformers in this country have agreed to recognise the priority of the Jablochkoff patent, which is now held by the United Electrical Engineering Company. Some twelve months ago the joint opinion of Messrs. J. F. Moulton, Q. C., and J. C. Graham, two of our leading counsel in patent law, was obtained as to the construction of this patent, which is No. 1,996 of 1877, and from which I may quote the following claim: "The use in apparatus for the production of electric light, of induction coils interposed in a primary electric circuit for generating separate and independent currents to be used for producing electric light in one or more lamps interposed in such secondary circuits, substantially as herein described." The United Electrical Engineering Company placed this opinion before the London Electric Supply Corporation and, after some negotiations, succeeded in inducing them to recognize the validity of their claim. This success was speedily followed by the adhesion of the Westinghouse Company, the Anglo American Brush Corporation and Messrs. Crompton & Co., the smaller makers soon following suit. I understand that the royalty was fixed at 5s. per horse-power. It is rather singular that although the existence of the Jablochkoff patent was several times referred to in the case just concluded, yet no very great stress was laid upon it, as an anticipation of Gaulard & Gibbs. If the decision had gone the other way and the Gaulard-Gibbs patent had been maintained, no doubt further legal proceedings would have followed, but as matters now stand it may be presumed that things will settle down quietly.

THE TELEGRAPH.

Westerly, R. I., proposes to adopt a fire-alarm system.

Canandaigua, N. Y., talks of putting in a fire-alarm plant.

Foxborough, Mass., is in the market for an electric fire-alarm system.

Cooperstown, N. Y.—The fire department, L. B. Crittenden, chief, is to put in a fire-alarm system.

Bucket Shop Profits.—According to the New York *World*, there is not so much money as formerly in bucket shop operation. It is said that only one shop in a hundred makes a profit, and that the bulk of the profits go in rent of offices, tickers and special wires.

Baltimore, Md., is to award contract for a police alarm and patrol service for the northeastern district of the city. The term for bids closed April 1.

Not Wanted by the Western Union.—The telegraph line from Poplar River to Fort Maginis in the department of Dakota, 232 miles in length, is the most costly of all the telegraph lines connected with the military service. The total receipts from the line during the past year were $155.17, while the cost to the government for maintaining and operating the section is over $4,000 annually.

Western Union Shows Fight.—An injunction was granted by Judge Wallace, of the United States Circuit Court, in this city on March 29, on application of the Western Union Telegraph Company, restraining the Mayor and the Board of Electrical Control from interfering with the poles or wires of that company. The order is made returnable on Wednesday, April 3. The Mayor referred the matter to to the Corporation Council to decide what action is to be taken.

THE TELEPHONE.

The Phonograph Business.—Over thirty sub-companies to carry on the phonograph business have now been formed in this country, and their capital stock amounts to about $20,000,000. The parent North American Phonograph Company has orders on hand for thousands of instruments.

New England Telephone.—At a meeting of the directors of the New England Telephone and Telegraph Company, held March 27, a dividend of 75 cents per share was declared, payable on Wednesday, May 15, 1889, to stockholders of record at the close of business on Friday, April 5, 1889. The transfer-book will be closed from April 8 to May 6, 1889, both days included.

Bell Telephone.—At the American Bell annual meeting last week, C. E. Hubbard was unanimously re-elected clerk and W. H Driver treasurer. The following gentlemen were elected directors, all save Stanton Blake being re-elections: Francis Blake, Stanton Blake, C. P. Bowditch, G. L. Bradley, Alexander Cochrane, W. H Forbes, C. E. Hubbard, G. G. Hubbard, J. E. Hudson, C. E. Perkins, Thomas Sanders, Howard Stockton.

THE ELECTRIC LIGHT.

Halifax, N. S., is to have a Fort Wayne Jenney plant.

Provo, Utah, has a new electric light company which means business.

Yazoo City, Miss.—Mr. C. H. Merry will buy a plant for city lighting.

Griffin, Ga.—The Thomson-Houston Co. has received franchise for a plant.

Greenville, Miss.—The Greenville Electric Light and Power Company will enlarge.

Lorain, O., has the street lighting question under consideration. Mr. J. Stack is city clerk.

Lonaconing, Md.—A new company to put in a Thomson-Houston plant is forming.

Bellville, Ill.—Baird & Co., of St. Louis, will put in the new incandescent plant at Belleville.

Springfield, Mass., is talking of a city electric light plant at $40,000, to be run for $18,000 a year.

Columbus, Ga.—The Columbus Electric Light Company will make improvements to the tune of $50,000.

Paris, France.—According to the Lynn, Mass., *Item*, Paris is to have a large Thomson-Houston plant.

Sharpsburg, Pa., has purchased a 50 arc light outfit from the Jenney Electric Company of Indianapolis.

Columbiana, O., has obtained authority from the legislature to purchase either a gas or an electric light plant.

Meridian, Miss.—The Meridian Electric Light and Power Company will put in plant for 1,000 incandescent lights.

The Consolidated Electric Light Company has declared a dividend of 1 per cent. for the quarter on its capital stock.

Harrisonburg, Va.—The Harrisonburg Ice Manufacturing Company, a new organization, has obtained electric lighting privileges.

Greenville, Tex.—The Greenville Water-Works and Electric Light Company will issue bonds for $100,000, to raise money for its plant.

Victoria, Tex.—Mr. G. A. Levi, of Victoria, is said to be in the market for a plant of about 500 incandescents. A company is being formed.

Newbery, S. C.—Mr. G. McWhorter has been appointed a committee by the Mayor to report on the cost of lighting; 18 arcs being required.

Chattanooga, Tenn.—Plant for an hotel of 150 incandescents and 10 arcs, including engine and wiring, is wanted by T. V. Hall & Co., Chattanooga.

South Hadley Falls, Mass., is to have its streets lit by the South Hadley Electric Light Company with incandescents at $18 each for 137 lights.

Fall River, Mass.—The Standard Electric Company, of Vermont, is putting in a plant of 600 incandescents in the Hargrave Mills at Fall River.

Greensburg, Pa.—The electric light plant is to be enlarged, and improved by Messrs. Huff, Coulter and Clarke, who have bought a controling interest.

St. Joseph, Mo., is going in heavily for a city electric light plant, and proposes to spend about $15,000 on the building alone. It will be a brick structure.

South Pittsburgh, Tenn—The electric light company recently organized has purchased a plant of 35 arc lights of the Indianapolis Jenney Company.

San Marcos, Tex.—The San Marcos Electric Light and Power Company has been formed by J. S. Green, J. Cook and L. W. Cooke, with a capital stock of $10,000.

Collinsville, Ill.—A certificate has been filed with the Secretary of State of Illinois dissolving the incorporation of the Collinsville Citizens' Electric Company.

Marietta, O., after receiving competitive bids and deliberating over the matter for several months, has purchased a 60 arc light plant of the Indianapolis Jenney system.

South End, Chicago.—The South End Electric Light Company, of Chicago, formed by F. D. Foster, G. Falkenburg, J. H. Thompson and others, has a capital stock of $30,000.

Martin's Ferry, W. Va.—The Martin's Ferry Construction Company has a contract for lighting the town for three years, getting $20 for each incandescent lamp and $90 for each arc.

Hempstead, N. Y.—The American Electric Illuminating Company, of Hempstead, L. I., has been formed by F. E. Townsend, P. Butterly and W. A. Cloutier, with a capital stock of $20,000.

Norwalk, Conn.—The people of Norwalk have voted overwhelmingly in favor of the electric light, and the Electric Light Company will get the contract which the Gas Company was also after.

Cartersville, Ga.—The Etowah Land and Mining Company has been formed by J. E. Brown and others, with a capital stock of $1,750,000. It has power, among other things, to build electric light plants.

The Gill-Alexander Electric Manufacturing Company has been formed at Kansas City, Mo., by R. Gillham, M. C. Gillham, E. R. Gill and W. W. Alexander, with a capital stock of $500,000.

The Eastern Electric Light Company, of Newark, has been formed by H. D. Lyman, S. G. Doron and C. S. Beardsley, of New York, and P. X. Schilgat, of Glen Ridge, N. J., with a capital stock of $1,000,000.

Lebanon, Ky.—The Lebanon Electric Light Company, recently formed by J. Rubel, W. T. Goodnow and others, has a capital stock of $15,000, and an exclusive franchise for 15 years. The plant will include electric light apparatus, an ice machine and a cooper shop.

In News Vans.—The London *Star* has adopted electric light as a novelty on its thirty-four paper distributing carts. A small storage battery is placed in the boot of the gig, and communicates with a 10 c. p. incandescent lamp fixed at the top of a rod which rises considerably above the highest point of the vehicle.

Fremont, Neb.—The Fremont Gas and Electric Light Company have put in a Westinghouse plant of 750 lights alternating system, the dynamo being driven by an Armington-Sims engine. The installation was made by the Keystone Construction Company, of Pittsburgh, and the Pond Engineering Company, of St. Louis.

Piqua, O.—The Piqua Edison Electric Illuminating Company has been awarded the contract for lighting the city streets with 200 to 250 incandescent lights, for the term of 5 years. The company contemplates buying and erecting a new outfit and operating it independently of its present system and lines, to be "the most modern and perfect it can find." Mr. H. K. Wood is president and general manager.

Redwood City, Cal.—The Ball plant recently installed at Redwood City was put in by the West Coast Electric Light and Construction Company, of San Francisco, who are the Californian agents of the Ball system. The work was done by Mr. Ridley, acting as superintendent of construction under the direction of the company. Mr. G. A. Newhall is president of the West Coast Company and Mr. J. Lloyd, secretary.

The Westinghouse Electric Company report recent installations of their Waterhouse arc lighting plants as follows: Central stations: Benicia, Cal., Electric Light Company, 10 lights; Allegheny, Pa., County Light Company, 200 lights; Florence, Ala., Electric Light Company, 35 lights. Isolated plants: Humboldt Lumber Mill Company, North Fork, Cal., 10 lights; Woolf, Son & Thomas, Johnstown, Pa., 20 lights.

Electric Light Bids in New York this year are: The Brush Company, 441 lights, at 35 cents a night each outside of the subway district, and 65 cents where the subways have to be used; the East River Company, 421 lights at 35 cents and 68 cents on the same basis; the United States Company, 429 lights at 35 cents; the Harlem Company, 89 lights at from 35 to 60 cents a light; the North New York Company, 28 lights at from 35 to 60 cents; the Mount Morris Company, 278 lights at from 25 to 55 cents. This company now furnishes only 18 lights at 32 cents, and by its new bid steps into territory now lighted by the United States, the Brush, the East River and the Harlem companies.

The Hawkeye Company.—The largest establishment of J. B. Clow & Company, Chicago, has just been furnished with a 200 light incandescent plant of the Thone system, manufactured by the Hawkeye Electric Co., of Davenport, Iowa. The plant was installed by Mr. W. M. Talcott, of 117 Dearborn street. The dynamo is absolutely automatic in its regulation, and requires no attention whatever. Any number of the lamps may be cut off or on at will. Mr. Talcott has sold two other plants in Chicago, which will be put in at once, in addition to several motors. The Hawkeye Company since their removal to Davenport from Oscaloosa on Feb. 23 last, have been running night and day, and are still behind orders.

APPLICATIONS OF POWER.

Houston, Tex., proposes to put in an electric street railway.

Laredo, Tex.—The Laredo Improvement Company will put in plant for an electric railway.

Washington, D. C.—It is stated that a company has been formed to run electric cabs over the asphalt pavements, and that it will have its cabs in service in a few months.

New Sprague Contracts.—Among the new contracts recently made by the Sprague Company may be mentioned Stillwater, Minn., 6 cars; Marlboro, Mass., 2 cars; Eau Claire, Wis., 6 cars; Wichita, Kan., 4 cars.

Wichita, Kan.—The Wichita *Eagle*, of March 10, reports the successful operation there of the Thomson-Houston electric railway extension, under Mr. E. Verstraete, engineer, who is rapidly increasing the stationary plant and rolling stock.

Buffalo, N. Y.—Mr. Silas Haines Hamilton, whose scheme for utilizing Niagara we illustrated and described recently, has secured the ear of the Business Men's Association, of Buffalo, who have appointed a special committee to arrange for a public meeting at which the plan can be brought to the attention of the people of the city.

Like an Elephant's Trunk.—A dispatch from Scranton, Pa., of March 21, says: A week ago Charles Nier, of this city, ran a needle into his foot. Surgeons sought in vain for it. This afternoon Nier was taken to the plant of the Suburban Electric Railway and his foot held near one of the dynamos. In fifteen minutes the needle was drawn out.

An Important Decision at Akron, O.—A special dispatch from Akron, O., of March 30, says: The first case in court between electric street railways and telephone companies was decided to-day. Judge E. P. Green refused to grant the Central Union Telephone Company an injunction restraining the Akron Electric Street Railway Company from extending its line in the city. The telephone company claimed that induction from the electric railway wires makes it impossible for many of its subscribers to use their instruments. John A. Wise, of Virginia, appeared for the

electric railway, and A. A. Thomas, of Chicago, for the telephone company, which gives notice of appeal.

MISCELLANEOUS NOTES.

Bridgeport, Conn.—The Bridgeport Scientific Society has formed a class in electricity.

Subway Rentals.—A bill introduced in the New York Assembly provides that the rental of ducts in the main subways in this city shall be $200 a mile per year, and in subsidiary ducts $250.

Discussing Gas Explosions.—The New York Subway Board spent a long session on Monday last discussing gas explosions in the conduits. Important evidence was given by experts, and the meeting was adjourned until Tuesday, April 2.

Correction.—In the test of the Detroit storage battery given recently typographical errors were made, as follows: Type 25 M.—Dec. 20-28, discharge mean E. M. F. should read 1.90 instead of 1.09. Type 25 M.—Jan. 8-14, discharge mean E. M. F., 2.05 instead of 2.5. Type 15 M.—Discharge of Dec. 4-8, omitted, and discharge of Dec. 19-24 used in its place, the charge of Dec. 19-24 being also omitted. Dec. 26-29, type 15 M., discharge mean E. M. F., 2.08 instead of 2.8. Jan. 8-14, discharge mean E. M. F., 2.06 instead of 2.6. Jan. 21, omit mean E. M. F. of charge.

The Julien Electric Company, in a special advertisement this week, assemble together in a striking manner the main points in the recent Coxe decision, as justifying and supporting their position in this great controversy. The grouping has been done very neatly and effectively, and will doubtless be read by every body with interest.

PERSONALS.

Mr. W. F. D. Crane has joined the forces of the Electric Car Company of America as electrician.

President F. L. Patton, of Princeton, announces that that institution is about to establish a course in electrical engineering.

Mr. Walter C. Kerr, president of the New York Association of Cornell University, presided at the ninth annual dinner, held at Delmonico's on March 28. Prof. E. P. Roberts replied to the toas of the faculty. Mr. Kerr expressed the hope that some day an alumnus hall would be built on the campus.

BUSINESS NOTICES.

The Western Electric Company, of Chicago, have received an award at the Melbourne, Australia, Exposition, for their exhibit of electric bells, annunciators, etc.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

Gould & Eberhardt, of Newark, N. J., have been awarded the contract for furnishing the Navy Department at Washington, D. C., with one Eberhardt entirely automatic gear cutter. Although a number of the best competitors were in the field, this Newark firm got the contract by merit of construction, as they were about the third lowest in price.

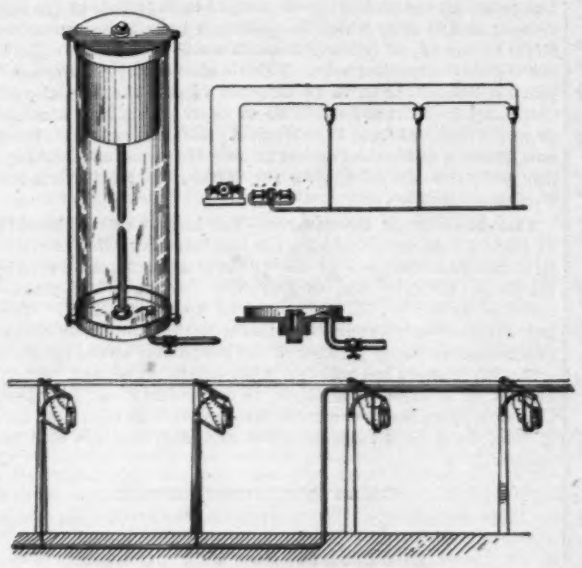
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS

PATENTS ISSUED MARCH 26, 1889.

(1) 400,038. (2) 400,179. (3) 400,180. (4) 400,181. (5) 400,182. (1) and (3) Electric Railway Plow; (2) Electric Railway Contact; (4) Method of Detecting Grounds in an Electric Distributing System; (5) Fault Detector for Electric Railways; Edward M. Bentley, of New York, N. Y. Applications filed, (1), (3) and (4), Dec. 5, 1888; (2) Aug. 9, 1888; (5) Dec. 17, 1888. (1) By this invention the contact plows are allowed two distinct movements. One is shared by the collector as a whole and permits the plow to follow the conduit, when for any reason the conduit deviates from parallelism with the axis of the track, and the second is a movement which each plow has independent of the other, whereby the contact will be readily preserved on curves, and wherever there are minor irregularities in the alignment of the road. (2) The combination, with an electrically propelled vehicle, of a contact device leading to a supply conductor in a conduit outside of the track, and a traverse guide for said contact device permitting a normal movement thereof, but having an extension permitting an abnormal movement of the contact devices. (3) The combination of the vehicle and a guide thereon with the contact device movable along said guide, and an extensible connection between the contact device and the vehicle. (4) and (5) A method of detecting grounds on an electric railway having a normally insulated line conductor which consists in first sending an irregular current through the grounded conductor, then moving along in proximity thereto an induction coil connected to an accessible indicator, and noting on the indicator the variation in the induced current caused by the coil passing the grounded point. See illustration.

400,088. Galvanic Battery; Carl E. Kammeyer, of Chicago, Ill., Assignor to the Electrical Supply Company, of Ansonia, Conn. Application filed Nov. 29, 1888. In a battery the combination of a cover with elements some of which are provided with heads inclosed within the substance of such cover and cast therewith and shaped so as to form shoulders bearing upon such substance within the cover.

400,126. Galvanic Battery; Frank Shaw, of New York, N. Y. Application filed January 3, 1889. The invention consists essentially, in a negative element of carbon comprising two con-



400,214. ELECTRIC LIGHTING SYSTEM.

centric cylinders attached together at one end and opened at their other to assist in circulation of the battery fluid.

400,130. Dynamo-Electric Machine; William L. Silvey, of Cincinnati, Ohio. Application filed Nov. 17, 1887. The field-magnet consists essentially of an iron ring, on which a wedge-shaped pole piece has its narrowest point projecting inward, in front of which the ring armature revolves.

400,139. Switch-Stand for Dynamo Stations; Robert Edward Stewart, of Dallas, Tex., Assignor to himself and John Hugh Spivey, of same place. Application filed Dec. 28, 1888. In a switch stand a pair of electrical contacts and a pair of swinging arms insulated from each other and adapted to be moved together to engage the contacts, a movable plate connected with the swinging arms and fitted to touch both electrical contacts.

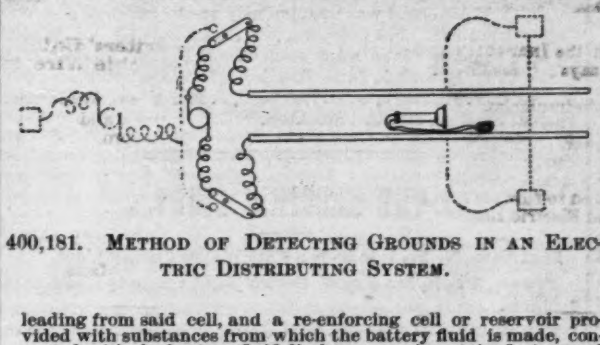
400,141. Telegraphic Transmitter; Ross C. Stone, of New York, N. Y.; Samuel Wesley Smith, Administrator of said Ross C. Smith, deceased. Application filed Dec. 1, 1887. A telegraphic transmitting-board consisting of an insulated metallic plate capable of connection to the line wire and an integral non-conducting covering for said plate, said covering being pierced by apertures representing the characters of a signal and covering the entire surface of said metallic plate except where perforated.

400,198. Electric Arc Lamp; Edgar A. Edwards, of Cincinnati, Ohio. Application filed Dec. 1, 1886. In a focusing arc lamp, the combination, with a movable or adjustable electrode and mechanism to adjust the same, of a non-consuming electrode and a guide embracing the movable electrode at or near the tip thereof.

400,214. Electric Lighting System; William L. Horne, of Meriden, Assignor to the Horne Vacuum Company, of Hartford, Conn. Application filed Oct. 28, 1887. It is well known that the carbons of arc lamps are rapidly consumed when burning in the open air, necessitating the supply of each lamp with fresh carbons at short intervals. This objection is avoided by the inventor by placing the lamp in a glass case and forming therein a total or partial vacuum, as may be found most efficient. See illustration.

400,215. Galvanic Battery; Alexander Imchenetzky, of St. Petersburgh, Russia. Application filed July 21, 1888. A galvanic element having a carbon electrode, a zinc electrode, and two liquids in which the said electrodes are respectively immersed, the liquid about the carbon consisting of dilute manganic acid, and the liquid about the zinc consisting of a solution of a sulphite or hyposulphite of an alkaline metal.

(1) 400,224. (2) 400,225. (3) 400,226. (4) 400,227. (1), (2) and (4), Voltaic Batteries; (3) Secondary Batteries; Isidor Kitsee, of Cincinnati, Ohio, Assignor to Mayer Sulzberger, of Philadelphia, Pa. Applications filed, (1) and (2) April 19, 1888; (3) May 10, 1888; (4) July 27, 1888. (1) In a voltaic battery cell, in combination, a solution of chloride of ammonia, or of chloride of soda, or of other chloride, bisulphate of mercury, and positive and negative elements immersed in said solution. (2) In a voltaic battery, in combination, a cell or cup provided with positive and negative elements, a battery fluid reservoir connected therewith by a supply pipe, a battery fluid discharge pipe



400,181. METHOD OF DETECTING GROUNDS IN AN ELECTRIC DISTRIBUTING SYSTEM.

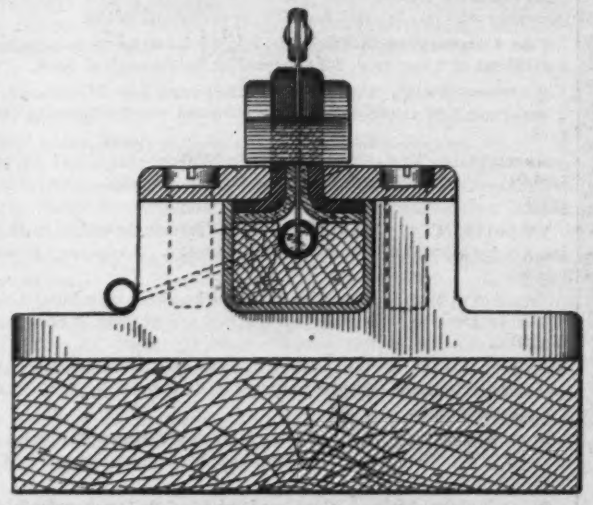
leading from said cell, and a re-enforcing cell or reservoir provided with substances from which the battery fluid is made, connected with the battery fluid discharge opening at the first-named cell and with the battery fluid supply orifice of the next cell of the series. (3) An electrode for a secondary battery, consisting of a plate of lead or other "element" substance, backed and supported by a supporting plate of suitable material unsusceptible to electrolysis or to corrosive action. (4) In a voltaic battery cell, in combination, an iron electrode immersed in a battery fluid containing chlorate of sodium, or a chlorate of other material, and a carbon electrode immersed in a battery fluid containing sulphuric acid.

400,232. Push-Button; Joseph Hufty Lehman, of Philadelphia, Pa. Application filed Aug. 8, 1888. Its object is to provide a button with a signaling apparatus which shall indicate to the operator the condition of the circuit in which the push-button is placed.

400,235. Galvanic Battery; Eduard Liebert and Sally Adolf Rosenthal, of Berlin, Germany. Application filed Nov. 30, 1888. An electrode for an electric battery, consisting of a non-conducting base, a coating or covering of foliated or leaf silver applied thereto, and chloride of silver applied to said coating.

400,239. Electric Burglar Alarm; Joseph Y. McKinney, of New Wilmington, Pa. Application filed Dec. 17, 1888. Details of a burglar alarm system.

400,264. Automatic Grounding Device; Elmer A. Sperry, of Chicago, Ill. Application filed April 5, 1888. The combination of a main, normally closed, metallic circuit with an electro-magnet therein, a ground circuit and contact, a pivoted armature lever adapted to move between such contact and the magnet, the



400,375. PNEUMATIC FLEXIBLE SLOT CONDUIT FOR ELECTRIC RAILWAY CONDUCTORS.

armature being held to the magnet by the influence of the current passing over the main line, and a motion-retarding device connected with such armature-lever, which permits the same to leave the magnet and engage the contact only when the current is discontinued for a considerable period of time.

400,300. Electric Conduit; Henry A. Chase, of Boston, Mass. Application filed Nov. 30, 1888. In an electric conduit, a supporting-frame provided with a division wall having an opening and forming within the frame a slot chamber and an accessible chamber, a removable cover for said accessible chamber and end walls for the chamber, provided with an opening, whereby communication may be established between the accessible chambers of adjacent supporting-frames.

400,304. Hotel Call; Edward J. Colby, of Chicago, Ill. Application filed May 10, 1888. The invention relates to electrical hotel calls, and has for its object to provide convenient means whereby an automatic call may be sent from the office to each room at any appointed hour, and whereby similar manual calls may be sent to the office, and whereby a manual call to one or more rooms may be sent at the same time if desired.

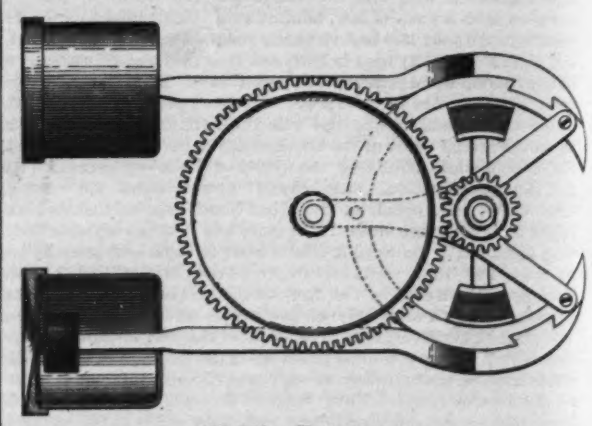
400,308. Method of Constructing Underground Conduits; William Clarence Cranmer and Sydney William Arnold, of Philadelphia, Penn. Application filed Oct. 19, 1888. The method of forming continuous underground conduits of plastic material for electric and other wires in a ditch or trench direct, which consists in providing a flexible casing composed of non-conducting material having a core of water, air, sand, sawdust, or the like, and temporarily hermetically closed at both ends, in building the conduit material around the said casing and subsequently freeing the core therefrom.

400,311. Electric Motor; Etna Hyde Davis and Reuben Westervelt, of Elmira, N. Y. Application filed Sept. 4, 1888. The object is to provide a motor which shall apply the full force of the stroke of the armature every time the electro magnet is operated. Heretofore the full force of the stroke has not been secured, owing to the fact that the magnet circuit has been broken a considerable length of time before the end of the stroke was reached. This apparatus is constructed so that the rupture of the circuit does not take place until the end of the stroke is nearly or quite accomplished.

400,315. Regulator for Electric Motors; Robert S. Dobbie, of New York, N. Y., Assignor to the American Electric Motor Company, of New Jersey. Application filed Dec. 12, 1888. A regulator for an electric motor, consisting of a two part shaft, one of which parts carries a pulley, the other being adapted to slide as well as rotate, a link or ball governor connecting said shafts, a spring normally holding the sliding shaft at its extreme position with a contact-point against which said sliding shaft may contact, and circuit-connections for connecting said regulator in circuit with the motor and source of electrical supply.

400,317. Ore Separator; Thomas A. Edison, of Menlo Park, N. J., Assignor to the Edison Milling Company (Limited), of New York, N. Y. Application filed August 25, 1882. The method of separating mingled conductors and non-conductors of electricity, consisting in causing them to fall together through a magnetic field whose lines of force are constantly shifting, whereby the trajectory of the conducting substances is changed.

(1) 400,325. (2) 400,326. (3) 400,327. (1) Telephone. (2) Telephone. (3) Magnetic Electric Generator; Noel B. Ginochio, of New York, N. Y., Assignor of one-half to Elias M. Greene, of same place. Applications filed (1) July 20, 1888, (2) Nov. 16, 1888. (3) Nov. 16, 1888. (1) A magnetic-telephone having a permanent magnet, a core fixed thereon supporting a coil, a case surrounding the coil supporting a diaphragm, and means for adjusting the diaphragm and case with relation to the core and magnet. (2) The invention relates to magneto-telephones, which operate without the aid of a battery current; and it has for its object to provide a simple, cheap, and effective construction, which embraces both the transmitting and receiving telephone and the generator for operating the call and signal bell. See illustration. (3) A magneto-generator in which the permanent magnets are made up of a cable or rope composed of a series of strands of steel wires twisted together, polar extensions connected to said wires, an armature



400,326. TELEPHONE.

rotating between the poles, and driving gear for said armature supported upon the magnet.

400,352. Arc-Lamp; William H. Miller, of New York, N. Y. Application filed June 26, 1888. This invention relates to the construction of arc-lamps, and comprises certain improvements in the feeding mechanism, the devices for cutting a lamp in and out of circuit both automatically and by hand, and also the formation of the negative carbon-holder and devices for the clamping of the globe, and the operation thereof for the purpose of cleaning and removing for trimming the lamp.

400,375. Pneumatic Flexible Slot Conduit for Electric Railway Conductors; Charles J. Van Depoele, of Lynn, Mass. Application filed Jan. 5, 1889. A slotted conduit for electrical conductors, comprising an exterior slotted casing, an interior insulating support and an electric conductor thereon, flexible insulating slot-closing strips located between the edges of the casing and the interior insulation, and means for supplying compressed air to the interior of the conduit for excluding or expelling water. See illustration.

400,378. Incandescent Electric Lamp; Edward Weston, of Newark, New Jersey, Assignor to the United States Electric Lighting Company, of New York, N. Y. Application filed May 5, 1881. The method of securing an electrical connection between the carbon conductor and metallic wires of an electric lamp, which consists in securing their respective ends in contact, as described, and then submerging the joints thus formed in an electroplating-bath until a metallic coating of the desired thickness is deposited on and around the same.

400,404. Secondary Battery; Rudolph M. Hunter, of Philadelphia, Pa. Application filed January 14, 1889. A secondary battery element or plate for holding active material, formed of lead, bismuth, and mercury, intimately associated.

PATENTS EXPIRED APRIL 2, 1889.

125,151. Improvements in Electro-Magnets; Isaac P. Tice, of New York, N. Y. A compound electro-magnet having its limbs surrounded by helices of unequal size or length, wound in opposite directions upon each of its limbs.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1836—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Potter Building, N. Y.

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